ارامكو السعودية
Saudi Aramco

Construction Safety Manual

Vol. 1: Contractor Safety Administrative Requirements (CSAR)

Vol. 2: Work Site Safety Manual (WSSM)

Saudi Aramco
Construction Safety Manual

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Construction Safety Manual

Introduction

Saudi Aramco is committed to the prevention of incidents to minimize loss of life and bodily injury to its employees and contractor/subcontractor employees, prevent damage to physical assets and protect the public against hazards resulting from its operations. As such, Saudi Aramco considers safety to be no less of a priority than other business considerations, including schedule and cost.

In support of this commitment, the Saudi Aramco Loss Prevention Department publishes the Saudi Aramco *Construction Safety Manual* (CSM). This is the fifth edition of the CSM since its introduction in 1974.

This edition of the CSM is divided into two volumes. Volume One is entitled the *Contractor Safety Administrative Requirements* (CSAR). Volume Two is entitled the *Work Site Safety Manual* (WSSM).

The purpose of the CSAR is to establish Saudi Aramco's contractual requirements for management of safety by the contractor company. Thus, the audience for the CSAR is contractor company corporate and site management, not workers at the job site.

The purpose of the WSSM is to establish minimum safety-related requirements for job-site activities. As such, the audience for the WSSM is Saudi Aramco and contractor/subcontractor workers and their supervision at the work site.

The scope of the WSSM includes all construction, operations and maintenance work performed by Saudi Aramco (SA), contractor and subcontractor personnel within SA facilities, on SA project sites and at project support facilities covered under SA Land Use Permits, including laydown yards. The WSSM expands upon Saudi Aramco's minimum safety rules in order to assist Saudi Aramco proponent departments and contractors perform their day-to-day work activities safely.

The basis for many requirements in this manual is in the reference section of each chapter. Use of a reference is mandatory when it is specifically adopted by a section in this manual. Other references are to be used for additional guidance as needed.

In the event no other Saudi Aramco general instruction, engineering standard, policy or procedure exists that addresses a particular hazard, then this manual shall govern. In case of conflicting requirements, the applicable Saudi Aramco general instruction(s) or engineering standard(s) shall take priority over this manual.

The petroleum/gas industry and its work environment are in constant change due to the development of new technologies, processes, regulations and the identification of new hazards/risks. Consequently, these changes necessitate continual review and updating of Saudi Aramco's safety requirements and standards. The Loss Prevention Department will issue interim revisions to this manual as appropriate.

Construction Safety Manual

Revision Log

Date	Volume	Chapter	Brief Description of Revision(s)
03/01/2012	2	I-13: Heat Stress	Sections 13.2.1 B; 13.13.3; 13.4.2 E, 13.4.2 F & 13.4.2 I
12/21/2012	2	I-11: Hand Tools and Power Tools	Sections 11.5.3, 11.5.9, 11.6.3, 11.7.1 to 11.7.13, 11.7.15, 11.7.16, 11.7.17B, 11.7.17C, 11.7.19A, 11.7.20C & 11.9.2J

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Saudi Aramco
Contractor Safety Administrative Requirements

1.0 Purpose

The purpose of this document is to establish Saudi Aramco's contractual requirements for a contractor company's management of safety. These contractual requirements establish minimum acceptable safety-related administrative standards and are intended to supplement, not replace, the contractor's own safety program. Contractors shall implement additional measures as necessary to ensure workplace safety and shall implement all applicable measures required by Saudi Arabian Government laws and regulations. Saudi Aramco (SA) considers safety to be no less of a priority than other business considerations, including schedule and cost.

2.0 Scope

These safety-related administrative standards shall apply to all contractor companies and their subcontractors working on long form contracts, mid form contracts and as applicable on short form contracts within SA facilities, on SA project sites and at project support facilities covered under SA Land Use Permits (including laydown, fabrication or maintenance yards), as well as contractor camps housing SA employees or contractor/subcontractor personnel who work on contracts with SA on or off SA property.

3.0 Standards

The requirements of the following SA standards are mandatory for contractor compliance.

SA General Instructions (GIs):

GI 2.100, *Work Permit System*

GI 2.102, *Pressure Testing Safely*

GI 2.709, *Gas Testing Procedure*

GI 2.716, *Land Use Permit Procedures*

GI 2.718, *Contractor Site Allotment Procedure*

GI 2.721, *Electrical Arc Flash Hazard Mitigation*

GI 6.007, *Reporting of Contractor On-Job Injuries/Occupational Illnesses*

GI 6.012, *Isolation, Lockout and Use of Hold Tags*

GI 6.025, *Control of Remote Area Travel and Search/Rescue Procedures*

GI 6.030, *Traffic and Vehicle Safety*

GI 7.024, *Marine and Offshore Crane, Hoist, and Rigging Operations*

GI 7.025, *Heavy Equipment Operator Testing and Certification*

GI 7.026, *Crane and Heavy Equipment Incident Reporting Procedures*

GI 7.027, *Crane Suspended Personnel Platform (Manbasket) Operations*

GI 7.028, *Crane Lifts: Types and Procedures*

GI 7.029, *Rigging Hardware Requirements*

GI 7.030, *Inspection and Testing Requirements for Elevating/Lifting Equipment*

GI 7.031, *Heavy Equipment Services*

GI 8.001, *Safety Requirements for Scaffolds*

GI 150.002, *Basic Life Support (BLS) Heartsaver Automated External Defibrillator (AED) / Standard First Aid (SFA) and First Aid Kit*

GI 151.006, *Implementing the Saudi Aramco Sanitary Code*

GI 298.010, *Administration Procedure of Contractor Camps/Parks and Construction Camps*

GI 430.001, *Waste Management*

GI 1021.000, *Street and Road Closure: Excavations, Reinstatement and Traffic Controls*

GI 1321.015, *Request for Air Medical Evacuation*

GI 1781.001, *Inspection, Testing and Maintenance of Fire Protection Equipment*

SA Engineering Standards (SAESs):

SAES-A-112, *Meteorological and Seismic Design Data*

SAES-B-014, *Safety Requirements for Plant and Operations Support Buildings*

SAES-B-017, *Fire Water System Design*

SAES-B-019, *Portable, Mobile and Special Fixed Firefighting Equipment*

SAES-B-055, *Plant Layout*

SAES-B-062, *Onshore Wellsite Safety*

SAES-B-064, *Onshore and Nearshore Pipeline Safety*

SAES-M-006, *Saudi Aramco Security and General Purpose Fencing*

SAES-M-100, *Saudi Aramco Building Code*

SAES-P-111, *Grounding*

SAES-P-123, *Lighting*

SA *Construction Safety Manual* (CSM)

SA *Medical Minimum Standards Requirements Manual* (MMSR Manual)

SA *Safety Handbook, Minimum Safety Rules*

SA *Sanitary Code* (SASC)

4.0 General Requirements

4.1 Contractor's Safety Program and Performance

A. The contractor shall establish an effective corporate (companywide) safety program that shall be fully implemented at each work site.

B. The contractor's corporate safety program shall be aligned with SA's safety requirements (e.g., as per Attachment A3 of the SA Safety Management Guide for Contractor Pre-Qualification Safety Evaluation) and shall govern how safety is managed throughout the contractor company.

C. The contractor's safety program shall be based on the safety/loss prevention policy formally endorsed by the contractor company's owner and/or senior management (e.g., CEO, President, General Manager).

D. The contractor's safety program shall include procedures for effectively evaluating potential subcontractors' safety programs and for conducting regular site safety performance evaluations of their subcontractor's work at the job site.

E. SA reserves the right to advise a contractor in writing of its objection to the safety program or safety performance of any subcontractor. The prime contractor retains full responsibility for the safety performance of his subcontractor(s). Contractor is not relieved from any liability or obligation as a result of contractor's use of subcontractors or SA's nonobjection of said subcontractors.

F. During planning and execution of contracted work, the contractor shall meet all SA safety requirements. Contractor site management shall ensure compliance with the requirements of this document, the SA *Construction*

Safety Manual (CSM), other applicable SA requirements and the Contractor Site Safety Program (CSSP) at the work site.

4.2 Contractor Safety Prequalification

In accordance with SA's contracting procedures, contractor companies are required to be successfully prequalified in safety (as per the SA Safety Management Guide, *Contractor Pre-Qualification Safety Evaluation*) before being eligible to be awarded a long form contact, mid form contract or short form contract for work to be performed within a SA facility or project site or where the SA proponent organization (SAPO) considers the work to be inherently dangerous.

4.3 Contractor Prejob Safety Explanation Meetings

A. The SAPO will communicate relevant general and site-specific safety standards and information to the contractor during prejob safety explanation meetings, including:

- Job Explanation (Job X) meetings, which are held with potential bidders, and/or
- Kick-off meetings, which are held with the contractor that is awarded the contract before they begin on-site work activities.

B. Following the prejob safety explanation meeting, the contractor shall attend any site hazard identification tour led by the SAPO, with participation by SA Loss Prevention Department (LPD), as required.

C. Safety, health and environmental standards and information covered during these meetings may not represent all areas of potential hazard to the contractor/subcontractor's personnel and equipment. It shall be the contractor's responsibility to fully comply with the contract, including identifying and addressing all potential safety, health and environmental hazards, and to include the costs of compliance in the contract.

4.4 Facility Safety Orientation

SA requires all contractor and subcontractor personnel to attend a facility-specific safety orientation prior to receiving their SA plant ID and/or being allowed to work on-site. Multiple safety orientations may be required if a plant ID permits access to more than one facility (e.g., one orientation for each facility). Unless provided by the SAPO, the contractor shall provide translation of the safety orientation presentation(s) and materials into languages understood by its employees.

4.5 Contractor Site Safety Staff

A. Contractor shall provide full-time and qualified site safety staff in accordance with Table 4.1, with respect to the maximum number of contractor and subcontractor employees who are present at the job site at

a given time, or as otherwise requested by the SAPO (e.g., during a Job Explanation meeting).

Table 4.1 Contractor Site Safety Staff Requirements

# Employees	Safety Manager Required	Min. # Safety Supervisor(s) Required	Ratio of Safety Officers to Employees Present (min.)
1 – 25	No	No	None
26 – 50	No	One (1)	None
51 – 500	No	One (1)	1:50
501 – 1,000	Yes	1 for every 10 safety officers	1:50
1,001 – 5,000	Yes	1 for every 10 safety officers	20 officers plus additional at ratio of 1:100
5,001+	Yes	1 for every 10 safety officers	60 officers plus additional at ratio of 1:150

B. The site safety manager (whose job title could also be site safety superintendent, senior safety engineer, safety coordinator, etc.) shall be fluent in spoken and written English and shall have at least 10 years of safety experience specific to the contract's scope of work.

C. Site safety supervisor(s) shall be fluent in spoken and written English and shall have at least seven years of safety experience specific to the contract's scope of work.

D. All field safety officers (whose job title could also be safety inspector, site safety engineer, safety advisor, safety representative or similar position) shall be fluent in spoken and written English and have at least five years of safety experience specific to the contract's scope of work.

Note: Safety officers with less than five years of safety experience, as well as clerical, fire watch, confined space standby men, hazardous materials handlers, etc., shall be excluded from the numbers of safety staff in Table 4.1. Contractor is advised that additional safety officers may be necessary based on the risk of the activities to be performed and as requested by the SAPO.

E. The contractor shall provide the safety manager and each safety supervisor with a personal means of communication (e.g., mobile phone) and a dedicated motor vehicle equipped for the travel environment that may be encountered during the course of his work.

F. The names and qualifications (e.g., CV/resume, training certificates) of the safety manager, site safety supervisor(s) and all field safety officers who will work on the job shall be submitted to the SAPO for review and concurrence prior to beginning work.

G. Prior to beginning work, the SAPO will review the qualifications of the contractor's on-site safety staff, including years of relevant safety work experience, academic education and degree(s), formal safety training and internationally recognized safety certifications (e.g., OSHA, NEBOSH, NSC). If requested by the SAPO, the contractor's safety staff shall also take and pass a written examination and/or interview.

H. The SAPO reserves the right to reject proposed safety staff personnel based on review of their qualifications.

I. The safety manager/supervisor and field safety officer positions shall be filled prior to commencement of on-site work and shall remain filled until completion of work.

J. Contractor safety staff personnel shall not be assigned dual roles (e.g., Not a site safety officer and the scaffold inspector).

K. During the course of the work, safety staff qualifications shall be made available for review at the contractor's site office as requested by the SAPO.

L. Contractor's site safety staff personnel shall be present at the job site at all times while contractor and/or subcontractor personnel are working, including nights, weekends, holidays and extended working hours.

M. The SAPO reserves the right to require the contractor to replace the safety manager/supervisor or any safety officers whose work is deemed unacceptable by the SAPO.

N. The SAPO reserves the right to require the contractor to provide additional safety and health specialists where special technical expertise is required.

4.6 Safety Meetings

A. Contractor's site supervision shall conduct prejob ("toolbox") craft safety meetings with their personnel to address job-specific safety issues prior to beginning a different work activity. These prejob craft safety meetings shall include a review of applicable sections of the hazard identification plan (HIP). See Section 6.0.

B. Contractor's site supervision shall also conduct weekly safety meetings in the native language of the attendees. Attendees shall include contractor's and subcontractor's site personnel. These safety meetings shall be no shorter than 15 minutes and shall cover, but not be limited to, work hazards and related job procedures, as well as a review/update of the HIP.

C. Weekly safety meetings shall be documented with records maintained and shall be made available for review by the SAPO upon request.

D. Contractor site management shall attend and participate in the contractor's weekly safety meetings.

E. Upon request by the SAPO, contractor's site management, site supervision and/or site safety staff shall attend the SAPO's safety meetings (e.g., safe operations committee [SOC] meetings, safety coordination meetings).

4.7 Contractor Site Management Safety Meetings

In addition to making safety an agenda item at regular internal contractor company management meetings (e.g., project progress meetings), contractor site management (e.g., project manager, construction managers, site superintendents) shall conduct a separate meeting, at least monthly, to discuss safety, health and environmental issues. Minutes of these meetings shall be documented. Action items and needed corrective actions shall be documented and tracked until closed. Copies of these documents shall be provided to the SAPO upon request. Attendees shall include senior site supervision, the safety manager/supervisor(s), safety officers, key field personnel and, if requested, representatives from the SAPO and other applicable SA organizations.

4.8 Hazard Control and Personal Protective Equipment (PPE)

A. Hazards not eliminated through design shall be mitigated by appropriate administrative controls (e.g., safe work procedures) and/or personal protective equipment (PPE) controls.

B. Contractor and their subcontractor(s) shall provide the proper PPE (e.g., hard hat, safety glasses, safety shoes, hearing protection, gloves) that meets SA specifications to its employees. See Chapter I-3, *Personal Protective Equipment (PPE)*, of the SA *Construction Safety Manual* (CSM).

C. Contractor and subcontractor personnel who work in SA plant areas where use of flame resistant clothing (FRC) is required or who may be exposed to a flash fire hazard shall be provided by their employer with the proper type, size and quantity of FRC in accordance with SAPO requirements.

D. The type, size and quantity of arc flash PPE and FRC per GI 2.721 shall be provided to electrical workers by their employer and shall be properly used.

4.9 Health and Environmental Monitoring

Health and environmental monitoring shall be conducted by the contractor, as applicable (e.g., as identified in the HIP), to protect their personnel against exposure to health hazards (e.g., radiation, H_2S, respiratory, noise). Monitoring shall be performed by qualified personnel and the results shall be submitted to the SAPO for review upon request.

4.10 Behavioral Observation and Site Safety Inspection

A. The contractor shall implement behavioral observation and site inspection programs to detect and correct unsafe acts and conditions. Observations and inspections shall be frequently (e.g., weekly) conducted by contractor site management (e.g., project manager, construction manager, site superintendent), safety staff, supervisors and employees, who shall be properly trained.

B. Unsafe acts and conditions shall be immediately reported to the relevant supervisor for correction as soon as practical. Life threatening hazards shall be corrected immediately. Corrective actions for unsafe conditions shall be identified and tracked until completion, with follow-up to verify proper implementation.

C. Contractor shall perform trending and analysis of behavioral observations and site safety inspections to identify negative trends and mitigate safety problems.

D. Statistics of inspection findings and observations shall be used to establish the priority of safety talks and training topics.

E. Contractor shall provide copies of any and all inspection and observation records as requested by the SAPO.

4.11 Site Safety Performance Monitoring

A. The SAPO will monitor, evaluate, inspect and report contractor job site safety performance. Performance monitoring will be performed in accordance with the SA Safety Management Guide, *Contractor Site Safety Performance Monitoring* and/or Project Management's Project Safety Index (PSI). Contractor shall participate in site safety evaluations and inspections, as requested by the SAPO.

B. A rating of "poor" (4) or "unsatisfactory" (5) in any evaluation category on the SA Contractor Site Safety Evaluation Form (Attachment A3 in the SMG) or PSI is considered a violation of the safety requirements of the contract. In this case, the SAPO reserves the right to conduct performance counseling meeting(s) with contractor management and/or take other measures in accordance with SA's contracting procedures.

C. Corrective actions shall be implemented by the contractor within any SA-specified time period and in accordance with Section 4.14 herein. Corrective actions shall be identified and tracked until completion, with follow-up to verify proper implementation.

4.12 Work Permits

A. For work to be carried out in a SA-specified "restricted area," or as may be required by the SAPO, contractor and subcontractor personnel shall

comply with the requirements of GI 2.100, GI 2.102, GI 2.709, GI 6.012, as well as Chapter I-4, *Work Permit System*, of the CSM.

B. Contractor's and subcontractor's work permit receivers shall obtain the proper work permit (e.g., hot work permit or cold work permit) and any associated confined space entry and release permits for work to be carried out in a SA-specified "restricted area" or as may be required by the SAPO.

C. Contractors shall maintain records of their current receiver certificate holders, with their names and corresponding certificate expiration dates.

4.13 Jobsite Safety Logbook (JSL)

A. For capital project construction contracts and other long form contracts as requested by the SAPO, a hardbound Jobsite Safety Logbook (JSL), supplied by the contractor(s), shall be maintained at the SA job site office. The JSL shall have pages that are sequentially numbered.

B. The SAPO (e.g., SA Project Management), LPD or other SA personnel will enter their name, date and comments regarding safety observations in the JSL on the left-hand page.

C. Contractor shall immediately take necessary corrective actions to mitigate observed safety hazards, including those documented in the JSL.

D. Contractor responses shall be entered within 48 hours on the right-hand page opposite the SA entry. Contractor responses shall clearly state action items, responsible parties, and estimated time for completion (ETC) in order to close the entry.

E. A member of the contractor's site management (e.g., project manager, job manager, site superintendent), other than safety staff, shall sign/date that entries are properly closed.

F. The SAPO reserves the right to notify contractor of failure to properly close JSL entries and to take necessary actions to eliminate the subsequent deficiency.

G. Failure to correct deficiencies noted in the JSL may result in that part of the job site work activities being suspended at the contractor's expense until the noted safety deficiencies have been corrected.

H. JSLs shall be given to the SAPO when all pages are filled and/or at job completion.

4.14 Failure to Comply

A. Upon receiving notification from the SAPO of failure to comply with the requirements of the contract and any actions needed to prevent the injury or death of personnel, damage to equipment, loss of process or damage to the environment during performance of work, the contractor shall

immediately take all necessary actions including, but not limited to, action requested by the SAPO.

B. If contractor fails to take prompt corrective action, the SAPO may direct the contractor to suspend all or part of the work until satisfactory corrective action has been taken. Costs incurred by contractor as a result of such work suspension shall be solely the contractor's responsibility.

C. Disputes involving safety shall be elevated to the contractor's higher management for resolution before work can proceed.

4.15 Transportation

A. Contractor and their subcontractors shall provide safe and adequate transportation to and from the work site for their employees.

B. The contractor shall install and maintain roads as needed to access the work site (e.g., for remote capital projects).

C. Contractor-provided transportation shall stop at a safe location completely off the main road or highway (e.g., on a side street or authorized bus stop) and contractor personnel shall only disembark on the safe (i.e., sidewalk) side.

D. Motor vehicles used for transportation of contractor's employees shall have a valid SA sticker (if required to enter a SA facility) and be kept in a clean and hygienic condition. Automobiles shall be air-conditioned. Defective vehicles shall not be used for transportation.

E. Contractor's employees shall be transported in the passenger compartments of motor vehicles equipped with seat belts for all occupants. All seats in cars and trucks shall face forward.

F. For larger sites, suitable buses may be used for transportation of employees. Buses without seat belts shall not be used after Jan. 1, 2015. Newly purchased buses shall have seat belts provided for all occupants and have air-conditioning installed.

G. Seat belts shall be continuously worn by all occupants of motor vehicles and buses in motion.

H. Buses shall not be overloaded (no more occupants than the manufacturer's stated seating capacity of the bus) and emergency exits shall be accessible and operable (not blocked or locked). Buses shall be equipped with fire extinguisher(s).

I. Motor vehicles and buses shall be in good working order. Documented inspections shall be performed for motor vehicles and buses at least monthly. Motor vehicles and buses shall be maintained in accordance with the manufacturer's instructions. The SAPO reserves the right to require

removal and replacement of any motor vehicle or bus deemed unsafe or unfit for its intended purpose.

J. Personnel operating motor vehicles and buses on SA property or project sites shall follow all Saudi Arabian Government regulations, GI 6.030 requirements and the rules and requirements in Chapter I-8, *Traffic and Vehicle Safety*, of the CSM.

K. Contractor site management shall develop and implement a remote area travel program per GI 6.025 to control travel and provide for any necessary search and rescue of their employees in remote areas.

L. For remote travel and oversize/heavy loads, the contractor shall implement a journey management program.

4.16 Fitness for Duty

A. Contractor shall verify that its personnel are fit for duty relative to medical, physical and substance abuse considerations.

B. Contractor shall arrange for vision check(s) for all employees needing or suspected of needing corrective lenses in order to perform their assigned work.

C. Contractor shall ensure that personnel requiring sight correction (as determined by a vision check) wear appropriate safety eyewear (i.e., prescription safety glasses with side protection or safety overglasses over standard prescription glasses). See Chapter I-3, *Personal Protective Equipment (PPE)*, of the CSM.

D. To prevent serious fatigue, contractor and subcontractor personnel shall not work excessive hours, with a maximum of 12 hours daily, except as may be requested/approved by the SAPO (e.g., during an emergency or unforeseen circumstances). Maximum work hours including portal-to-portal transportation shall not exceed 16 hours in any 24 hour period.

4.17 Heat Stress

A. Contractor management is responsible for managing their employees' work so as to avoid and prevent heat-related illnesses. Contractor shall ensure the requirements in Chapter I-13, *Heat Stress*, of the CSM are fully implemented at the work site.

B. Prior to performing work during hot weather, the contractor shall conduct a thorough heat stress evaluation to identify tasks and conditions that present a potential heat stress hazard. This evaluation shall include observations, discussions with workers and supervisors, review of any previously reported heat-related illnesses and shall be based on the U.S. Occupational Safety and Health Administration (OSHA) Technical Manual TED 01-00-015, Section III: Chapter 4, "Heat Stress" and/or the National Institute for

Occupational Safety and Health (NIOSH) *Occupational Exposure to Hot Environments*.

C. The contractor shall develop and implement a written heat stress management program based on the results of the heat stress evaluation, as well as SA's heat stress requirements. The contractor shall provide proper resources to support implementation of the plan, including but not limited to procurement and provision of materials and supplies. The contractor's heat stress management program shall be submitted to the SAPO for review and concurrence prior to the start of work during hot weather (i.e., prior to April 1).

D. The contractor's heat stress evaluation and management program shall address the following:

- Job Location — specific locations of each task, including proximity to heat-producing equipment, confined spaces, work requiring specialized PPE, etc.
- Work Duration and Schedule — frequency at which the task is performed and how much time and effort is required to perform the work.
- Clothing — what workers wear can make a big difference in how much body heat they build up. Additional work clothing and/or more frequent laundry cycles shall be provided to enable workers to wear clean clothes each day.
- Environmental Conditions — procedures to monitor air temperature and humidity and immediately communicate changing heat stress conditions to workers (e.g., use of color-coded flags and/or mass distribution of SMS mobile phone text messages to site supervisors and other personnel in nonrestricted areas).
- Controls — plan for and provide needed heat stress controls (i.e., engineering, administrative and personal protective controls) that shall be used to prevent heat-related illness. See Chapter I-13, *Heat Stress*, of the CSM.

E. Contractor shall provide training to site management and supervision on the heat stress management program, including recognition of, prevention of and response to heat-related illness, with emphasis on their responsibilities for ensuring safe working conditions (particularly suitable work/rest rotations for workers).

F. Contractor shall provide training and guidance to their employees in the recognition of, prevention of and response to heat-related illness.

4.18 Emergency Response

A. An emergency response plan (ERP) for each specific site shall be established by the contractor and/or by the contractor in coordination with the SAPO. For additional information, see the SA Emergency Management

Guide. The contractor's ERP shall be submitted to the SAPO for review prior to the start of work.

B. Contractors shall ensure that their ERP is aligned with the SAPO and/or SA facility's ERPs, as applicable.

C. Contractor shall train personnel on their specific roles in the ERP and shall conduct their own periodic emergency drills.

D. When an emergency alarm is sounded for any reason, all contractor personnel shall immediately shut down their job, make it safe and proceed in an orderly manner to the designated assembly point.

E. SA periodically conducts emergency response drills to perform and evaluate emergency response procedures. All contractor personnel are required to take part in these drills just as if it were an actual emergency as mentioned above.

F. Any action items from critiques of emergency drills that are applicable to the contractor shall be implemented by contractor site management. Review and verification of closure of these action items shall be performed during contractor site management safety meetings.

G. For projects outside of SA facilities, the contractor shall install a proper emergency notification system and alarm(s), which shall include prompt activation of emergency response personnel. Contractor shall periodically conduct emergency response drills to evaluate emergency response systems and procedures.

4.19 Authority for Employees to Stop Work

Contractor shall provide the SAPO with written evidence that its employees and subcontractor employees clearly have authority to stop their own work and the work related to the contract due to unsafe conditions or acts.

4.20 Incident Reporting and Investigation

A. Contractor shall establish a policy and procedures to promote timely reporting of all unsafe acts and conditions, near-misses, injuries and other incidents, in accordance with GI 6.007 and Chapter I-2, *Incident Reporting and Investigation*. Proper corrective actions shall be promptly taken.

B. Contractor shall investigate all incidents involving their personnel and/or their subcontractors' personnel and shall participate in any SA incident investigation as requested by the SAPO.

C. Contractor's incident investigations shall be performed in a timely manner and root causes of the incident shall be properly identified. Effective corrective actions to prevent recurrence shall be identified and tracked to completion, with follow-up to verify proper implementation.

5.0 Contractor Site Safety Program (CSSP)

5.1 Contractor shall properly plan and establish job-specific safe work procedures for all contracted work. For long form capital project construction contracts where SA Project Management is the proponent or as requested in writing by the SAPO, the contractor shall develop, implement and adhere to a ***job-specific*** contractor site safety program (CSSP) that conforms to the requirements of the contract, this document and all other applicable SA safety requirements. If requested by the SAPO, the contractor shall submit a supplementary detailed safety plan as may be needed before starting a new major phase of work.

Note: The CSSP replaces the previously required contractor Loss Prevention Program (LPP), which no longer needs to be submitted.

5.2 CSSP Submittal and Review Requirements

A. Within fifteen (15) working days of contract execution, contractor shall submit three copies of the job-specific CSSP to the SAPO for review. The SAPO will forward a copy of the CSSP to the Loss Prevention Department (LPD) and other applicable SA organizations for additional review.

B. Any review comments will be forwarded to the contractor for its action. Contractor shall address all comments and resubmit the CSSP to the SAPO for final review and concurrence. Contractor shall not begin work onsite until the job-specific CSSP for the contract, if required, has been concurred with by the SAPO. The contractor shall furnish two (2) copies of the final CSSP to the SAPO prior to the start of work and shall also maintain copies at the job site.

5.3 The CSSP shall state specifically ***how*** the contractor will meet SA's safety requirements for the work to be performed. The CSSP shall include the following, as applicable to the contract and work to be performed:

A. Title page, specifying budget item (BI), job order (JO) or contract number.

B. Job title and brief scope of work.

C. Site location map(s) with legend (symbols).

D. Contractor company's current safety policy (signed by their upper management).

E. Job-specific organization chart that clearly defines safety reporting relationships.

F. Names and qualifications (e.g., CV/resume) of safety manager/supervisor(s) and safety officers, as required.

G. Job-specific assignment of safety responsibilities by job classification.

H. Job-specific training needs analysis (e.g., training matrix) showing the safety training and job-skills/competency training required for all job classifications, as applicable to project's scope of work.

I. Written *safety* training program that includes: (1) a description of the basic safety training courses (e.g., first aid, fire safety, hazard recognition, confined space safety, H_2S safety, driving safety) provided to contractor company's employees, (2) how these safety training courses are delivered (e.g., in-house, third-party) and (3) which of these courses are required for each type of job (e.g., documented in a safety training matrix or safety training plan).

J. Written *job skills/craft competency* training program that includes: (1) a description of the specific job skills/craft training courses required for each type of job (e.g., HVAC technician, plumber, pipefitter, scaffolder, welder) that are specific to their work for SA, (2) how these job skills/craft training courses are delivered (e.g., in-house and/or third-party) and (3) refresher training frequency.

K. List of jobs to be performed that require SA-approved certification (e.g., scaffold supervisor/inspector, crane/heavy equipment operator, rigger, welder).

L. Complete list of known subcontractors.

M. Project-specific plan/program the contractor will use for managing their subcontractors, including their safety performance.

N. Procedures for behavioral observations, site safety inspections, safety meetings, incident/injury/near miss reporting and investigation, safety training, safety recommendation tracking, etc.

O. Description of contractor's site safety incentive and/or disciplinary action programs.

P. Hazard identification plan (HIP) as per Section 6.0.

Q. Waste management plan as per Section 10.0.

R. Hazardous substances plan, which describes the contractor's procedures for identifying and handling hazardous chemicals, materials, etc. Hazardous chemicals/materials shall be stored and handled in accordance with SA chemical hazard bulletins (CHBs) and the manufacturer's material safety data sheets (MSDSs).

S. Job-specific and/or location specific safety procedures that are applicable to the contract's scope of work. These procedures may include but are not limited to: work permits, confined space entry, PPE, respiratory protection, fall protection, lock-out/tag-out, waste management, site demobilization/restoration, emergency response, etc., (see Section 6.2 for additional topics).

Note 1: When the SAPO has applicable procedures, the contractor shall adopt them by reference with the contractor's job-specific safety procedures supplementing SA's requirements by explaining specifically ***how*** the contractor will meet SA's requirements. The contractor's safety procedures shall ***not be a verbatim copy*** of SA's safety requirements (e.g., copied directly from the SA *Construction Safety Manual*).

Note 2: If the SAPO confirms that they do not have the needed existing procedures or that their procedures are not applicable to the project, the contractor shall develop their own safety procedures.

5.4 Since the contractor is completely responsible for their subcontractors, the contractor shall verify that the safety procedures and safe work practices identified in each subcontractor's site safety program are adequate and satisfy SA's and the contractor's minimum expectations and requirements. In the event that any subcontractor's safety procedure or safe work practice does not meet the minimum expectation, contractor shall work closely with subcontractor to develop/upgrade the appropriate safety procedure or safe work practice. Contractor shall complete the verification process prior to commencement of the work. SAPO may participate in the development/upgrade process at their discretion.

6.0 Hazard Identification Plan (HIP) and Other Submittals

6.1 For all SA contracts (e.g., long form, mid form and short form contracts), the contractor and/or their subcontractor(s) shall develop, implement and adhere to a contract-specific HIP. The HIP shall list all tasks/activities associated with the contracted work, potential hazards of each activity and control measures to mitigate these hazards. The contractor's HIP shall identify all potential hazards associated with the work to be performed. The HIP shall not be a list of generic hazards.

6.2 The topics in Table 6.1 represent some, but may not be all, of the safety issues that shall be considered when developing the HIP.

Table 6.1 Possible HIP Topics

Abrasive blasting	Falling object prevention
Asbestos	First aid, medical facility, hospital transfer provisions
Blinding	Hand tools
Cartridge operated tools (Hilti)	Heat stress hazards
Chemicals and chemical handling	Heavy equipment operations
Communications	Housekeeping
Compressed gas cylinders	Hydrogen sulfide (H_2S)
Concrete formwork & shoring	Hydrotesting
Concrete placement	Impact on SA's operations
Confined space entry/rescue	Ionizing radiation
Cranes and rigging	Isolation/lockout/hold tag
Cutting, welding and brazing	Materials handling
Demobilization	Mechanical equipment
Demolition	Painting and coating
Driving/vehicle safety	PPE
Dust control	Portable power tools
Electrical safety	Scaffolding
Elevating/lifting equipment	Steel erection
Emergency response	Transportation
Excavations and shoring	Welding on lines in service
Explosives	Work at heights
Fall prevention/protection	Work over water
Fire prevention/firefighting	Work permits

6.3 Within fifteen (15) working days of contract execution, the contractor shall submit three copies of contractor's job-specific HIP to the SAPO for review. The SAPO will forward a copy of the HIP to the LPD and other applicable SA organizations for additional review.

6.4 Any comments will be forwarded to the contractor for its action. Contractor shall address all comments and resubmit the HIP to the SAPO for final review and concurrence. Contractor shall not begin work on-site until the HIP for the contract has been concurred with by the SAPO. The contractor shall furnish two (2) copies of the final HIP to the SAPO prior to the start of work and shall also maintain copies at the job site.

6.5 The contractor's job-specific HIP shall be revised and amended, as needed, when conditions change, new hazards are introduced or the scope of work changes.

6.6 In addition to the HIP, contractor shall submit, as applicable to the contract, job-specific plans such as, but not limited to: site layout plans, site-specific traffic flow plans, fire protection plans, security fence layout plans, project support facility plans (e.g., office, maintenance, sanitary, dining, laydown/storage facilities) and contractor camp plans (see Section 10.3 and Section 11.0 herein). The contractor shall submit three copies of these job-specific plans to the SAPO for review within fifteen (15) working days of contract execution. Contractor shall not begin work on-

site until the job-specific plans for the contract have been reviewed by the SAPO. Contractor shall furnish two (2) copies of these job-specific plans to the SAPO prior to the start of work and shall also maintain copies at the job site.

7.0 Contractor Personnel Safety Responsibilities

7.1 General

A. Each contractor employee working on SA jobs shall comply with the SA GIs, standards, manuals and other contract documents that are applicable to the work, including the SA *Safety Handbook*.

B. The contractor's line management and site supervision shall be fully responsible for compliance with SA's safety requirements. This responsibility shall not be delegated to the contractor's safety manager/supervisor(s)/officer(s).

C. Contractor supervisory personnel or other qualified staff shall be present at the job site while work is in progress.

D. The contractor shall remove from the job site any of its employees who refuse or repeatedly fail to comply with safe work practices or supervisors who fail to enforce compliance, including as requested by the SAPO.

E. Listed below are some responsibilities associated with specific contractor job categories, as applicable (e.g., specific management and supervisory job categories may not be required or may be combined if agreed to by the SAPO). Contractor personnel working on SA jobs shall abide by these responsibilities.

7.2 Contractor Management

Contractor company management shall:

- Ensure compliance with SA's safety requirements for the control of injury, damage and fire as stated in the contract, in particular Schedule "D" and this document.
- Ensure preparation and submittal of a contract-specific CSSP and/or HIP, as required by the SAPO.
- Ensure the contractor's subcontractor selection process includes an evaluation of subcontractor safety management program and performance.
- Provide the necessary personnel, training, tools, equipment and materials to enable the work to be performed competently and safely.
- Train and qualify contractor site management and supervision on their job safety responsibilities, including incident investigation and job safety analysis (JSA).

- Conduct training needs analysis to determine the required training for all levels of contractor employees.
- Ensure contractor employees are trained and qualified on their safety responsibilities.
- Provide needed PPE and establish training/procedures to ensure proper PPE selection, use and maintenance.
- Participate in coordination (interface) meetings between SA, subcontractors and any other contractors that may be working on the same jobsite to coordinate work activities.
- Ensure development, SAPO review and implementation of detailed procedures for critical work activities such as welding, tie-ins, hot taps, loop tests, excavations, confined space entries, equipment/vehicle access, etc.

7.3 Contractor Site Management

A. The contractor's site management (project manager, construction manager, site superintendent or equivalent position) shall establish the following at the planning stage:

- Safety responsibilities for supervisors, subcontractors and other personnel.
- Fire prevention and protection provisions.
- Emergency vehicle access.
- Specific hazards to be identified in the CSSP and/or HIP.
- Job-skills/craft training and safety training/orientation requirements for personnel.
- Types and quantities of PPE needed.
- First aid, medical and sanitation facilities needed.
- Work permit procedures and requirements, if not already established by the SAPO.
- Emergency Response Plan (ERP) and/or emergency procedures aligned with any applicable SAPO ERP.

B. The contractor's site management shall be fully responsible for implementation of all contractual requirements at the job site and shall visibly demonstrate the priority of safety in all activities, including setting a good personal example and as follows:

- Empower all contractor and subcontractor personnel on site to stop their own work and work related to the contract that they deem to be unsafe and take immediate corrective actions as needed.
- Understand and implement the safety and health requirements of the contract, in particular Schedule "D" and this document.

- Implement the CSSP and/or HIP and convey the safety responsibilities of each level of supervisory staff.
- Use only SA-certified work permit receivers when work will be conducted in SA restricted areas or where required by the SAPO.
- Implement contractor's work permit procedures in work areas where SA work permits are not required or as requested by the SAPO.
- Attend/conduct safety meetings to promote and reinforce proper safety and health performance.
- Periodically inspect the work site, report any unsafe acts/conditions to the contractor's site supervisor and/or foreman, provide recommendations to correct deficiencies and perform follow-up inspections to ensure corrective actions have been taken.
- Routinely consult with the contractor's safety manager/supervisor(s)/officers to assess the job site safety status and identify areas for supervisors and foremen to take corrective action.
- Provide and maintain a Jobsite Safety Logbook (JSL) at each separate job site (note: the JSL shall be used by SA and the contractor to document unsafe acts/conditions and the corrective actions taken).
- Ensure that the appropriate supervisor or foreman responds immediately to comments written in the JSL.
- Review work methods and precautions with site supervision before work starts.
- Immediately report all incidents and near misses to the SAPO in accordance with GI 6.007 and Chapter I-2, *Incident Reporting and Investigation,* of the CSM.
- Ensure incidents and near misses are properly investigated to determine root causes, make recommendations to prevent recurrence and that corrective actions have been taken.

7.4 Site Safety Manager/Supervisor

The contractor's site safety manager/supervisor (site safety superintendent, senior safety engineer, safety coordinator or equivalent position) shall visibly demonstrate the priority of safety in all activities, including setting a good personal example and as follows.

- Be responsible and accountable for the proper performance of field safety officers under his authority.
- Be empowered in writing by his management to stop their own work and work related to the contract that they deem to be unsafe and take immediate corrective actions as needed.
- Understand safety and health requirements of the contract — in particular Schedule "D" and this document — as well as the CSSP/HIP and CSM.

- Conduct safety kickoff meetings with subcontractors to explain site-specific safety requirements and expectations.
- Ensure all contractor and subcontractor personnel attend site safety orientations, including as required by the SAPO, and ensure contractor and subcontractor personnel attend applicable safety training.
- Communicate safety rules and standards to the contractor and subcontractor workforce.
- Provide/assist with safety training for personnel.
- Periodically inspect the work site, report any unsafe acts/conditions to the area supervisor and/or foreman, provide recommendations to correct deficiencies and follow-up to verify corrective actions have been taken.
- Keep a record of safety meetings, including agendas and personnel attendance records.
- Keep a permanent record of job-related injuries/illnesses, near misses, fires, motor vehicle accidents, property damage, crane and heavy equipment incidents, etc.
- Participate in incident investigations, safety meetings, drills, etc., and conduct/facilitate safety training sessions.
- Ensure general safety rules are printed in languages understood by contractor and subcontractor personnel and are posted in areas where they are clearly visible.

7.5 Project Engineer

A. The contractor's project engineer (project superintendent or equivalent position) shall immediately notify the contractor's site management and the SAPO of the following:

- Injury or death of personnel, damage to equipment, loss of process or damage to the environment.
- Safety infractions noted during site inspections, etc.

B. The contractor's project engineer shall visibly demonstrate the priority of safety in all activities, including setting a good personal example and as follows:

- Conduct daily site inspections and evaluate safe work methods in operation.
- Monitor compliance with Saudi Arabian Government regulations and SA requirements, including the adequacy of sanitation and first aid/medical facilities.
- Provide/assist with safety training for personnel.

- Meet and discuss with the SAPO, regarding injury or death of personnel, damage to equipment, loss of process or damage to the environment.
- Obtain and circulate relevant safety information applicable to personnel.
- Attend safety meetings and report on-job safety performance.
- Participate in incident investigations, drills, etc., and conduct/facilitate safety training sessions.

7.6 Site Supervision

The contractor's site supervision (field engineers, supervisors, foremen or equivalent position) shall visibly demonstrate the priority of safety in all activities, including setting a good personal example and as follows.

- Be qualified, proficient in both verbal and written English, provide direct and effective on-site supervision and be continuously present on-site.
- Be empowered in writing by their management to stop their own work and work related to the contract that they deem to be unsafe and to take immediate corrective actions as needed.
- Understand the safety and health requirements of the contract — in particular Schedule "D" and this document — as well as the contractor's CSSP and/or HIP.
- Assess the workplace and work activities to determine hazards that are present or are likely to be present, in consultation with the safety manager/supervisor(s) or field safety officer as needed.
- Evaluate hazardous operations and implement needed precautions to ensure the safety of all affected personnel (note: hazardous operations may include, but are not limited to: welding, radiography, abrasive blasting, asbestos removal, electrical work, solvent cleaning, crane operations, etc.).
- Understand the safest method of performing each job activity in their area of responsibility.
- Provide instructions to their personnel on proper work methods, sequence of operations, potential hazards at each stage and precautions to follow.
- Inform their personnel of safe work methods and safety requirements detailed in the CSSP and/or HIP prior to beginning a different work activity (i.e., conduct prejob "toolbox" craft safety meetings).
- Use only trained personnel who are properly qualified for the work to be performed.
- Ensure that equipment operators operate only the specific equipment for which they have been trained and/or certified.

- Plan and maintain good housekeeping in the work area.
- Coordinate with subcontractors and other contractors on-site to avoid confusion in areas with joint or overlapping responsibility or joint occupancy (note: this includes work that may be separate and unrelated).
- Position temporary equipment to avoid safety hazards.
- Provide the required PPE and ensure proper use.
- Ensure equipment and tools (both power and hand tools) are in good operating condition and properly used.
- Train their personnel on emergency response procedures/plans.
- Provide immediate assistance as requested by the contractor's safety manager/supervisor, emergency response organizations, SAPO, etc., during emergencies.
- Conduct weekly safety meetings for their personnel.
- Conduct daily work site inspections to identify and immediately correct unsafe acts, conditions and/or equipment.
- Document and coordinate safety inspection activities and findings with the safety manager/supervisor.
- Commend personnel who, by action and/or initiative, eliminate hazards.
- Immediately report all incidents, unsafe conditions and defects in equipment to the contractor's site management and the SAPO.
- Participate in incident investigations, safety meetings, drills, etc., and conduct/facilitate safety training sessions.

7.7 Field Safety Officer

The contractor's field safety officers (safety inspector, site safety engineer, safety advisor, safety representative or equivalent position) shall visibly demonstrate the priority of safety in all activities, including setting a good personal example and as follows:

- Be empowered in writing by their management to stop their own work and work related to the contract that they deem to be unsafe and take immediate corrective actions.
- Understand the safety and health requirements of the contract — in particular Schedule "D" and this document — as well as the CSSP/HIP.
- Communicate safety rules and standards to the contractor and subcontractor workforce.
- Inspect the work site daily, report any unsafe acts/conditions to the supervisor and/or foreman, provide recommendations to correct deficiencies and follow-up to ensure corrective actions have been taken.

- Participate in incident investigations, safety meetings, drills, etc., and conduct/facilitate safety training sessions.

7.8 Equipment Manager/Supervisor

A. The contractor's equipment manager/supervisor or equivalent position shall ensure that all equipment purchased, rented or leased:

- Has proper guarding for electrical, mechanical and chemical hazards.
- Is equipped with required safety devices.
- Has required testing laboratory stamps, labels and certifications affixed.

B. The equipment manager/supervisor shall visibly demonstrate the priority of safety in all activities, including setting a good personal example and as follows:

- Attend and participate in safety meetings.
- Verify heavy equipment operators are certified as required by SA.
- Ensure compliance with the requirements of GI 7.024 through GI 7.031 as applicable.
- Ensure hand-held electrical equipment and power tools are rated at 110 volts.
- Ensure tools constructed of good quality materials are used. Use of "homemade" tools is prohibited.
- Ensure periodic tests, inspections and maintenance of equipment are carried out when due and records are properly maintained and available for review by the SAPO.
- Ensure equipment defects are promptly repaired and defective equipment is immediately "red tagged", removed from service and discarded/destroyed.

7.9 Contractor Personnel

Contractor personnel shall visibly demonstrate the priority of safety in all activities and shall:

- Be empowered in writing by their management to stop their own work and work related to the contract that they deem to be unsafe (without fear of retribution).
- Immediately report all incidents or hazardous conditions to their supervisor.
- Never endanger themselves or their fellow workers, including refraining from horseplay.
- Take and pass required job-skills/craft training and safety training.

- Understand safety rules, safe work practices and follow special safety precautions (e.g., in SA restricted areas).
- Properly use the correct tools and equipment for the job.
- Keep tools in good condition and repair.
- Properly use the correct PPE.
- Never remove, modify or abuse safety devices, equipment and welfare facilities.
- Attend and participate in safety meetings, "toolbox talks", safety training, etc.
- Obey posted warning signs.

8.0 Personnel Qualifications, Training and Certification

8.1 General

A. Contractor shall ensure that all its personnel are qualified, competent and have demonstrated they have the necessary knowledge and skills to safely and properly perform their assigned work.

B. Contractor shall ensure their personnel receive documented training, based on job classification and training needs analysis, before being permitted access to the work site. This training shall include: (1) safety orientation, (2) job-specific safety training and (3) job-skills/craft competency training for personnel engaged in specific craft activities (e.g., electrical, scaffolding, steel erection, welding, cutting, crane/heavy equipment operation).

C. Contractor shall establish job classifications (e.g., welder, rigger, crane operator, heavy equipment operator, driver) required to perform the work and the specific job skills/craft competence and training requirements for each of these job classifications, including Saudi Aramco and/or Saudi Arabian Government certification/license requirements.

D. Where a specific job function requires SA and/or Saudi Arabian Government certification/license, these job functions shall be assigned only to properly certified/licensed personnel (e.g., certified crane/heavy equipment operators per GI 7.025, certified scaffold supervisors/inspectors per GI 8.001).

E. Contractor shall establish additional training programs for personnel who perform high-risk activities, such as but not limited to: confined space entry, fire watch, isolation and lock-out/tag-out, working on or near energized electrical equipment, working at height, lifting and rigging, excavation, specialized power tools and equipment, handling of hazardous chemicals, waste storage and handling, etc.

F. Contractor's in-house or third-party training shall include:

- Training facilities complete with multimedia (audio/visual) resources.
- Qualified instructors to ensure personnel properly receive the required training.
- Verbal instruction and written materials in a language clearly understood by the personnel receiving the training.
- Documented post-training competency assessments.
- Documentation of completed safety training (e.g., pocket card, "safety passport" or file copies of training records).

G. Personnel shall maintain the required SA and/or Saudi Arabian Government certification/licenses in their possession at all times.

H. Contractor shall work closely with their subcontractors to provide training programs to ensure that subcontractor personnel have the necessary knowledge and skills required to safely and properly perform the assigned work.

8.2 Safety Orientation for Contractor Employees

A. Contractor companies shall ensure that their employees and subcontractor employees who are new to a particular work site attend and pass their own company's safety orientation, as well as any facility safety orientation that may be required by the SAPO.

B. The contractor's safety orientation program shall include an overview of relevant requirements in the SA *Safety Handbook* and *Construction Safety Manual* (CSM).

C. The contractor's safety orientation program shall include, but not be limited to, the applicable topics shown in Table 8.1.

Table 8.1 Contractor's Safety Orientation Topics

Alarms and notifications	Incident reporting procedures
Assembly points	PPE
Basic safety rules	Smoking restrictions and locations
Break areas	Traffic rules and restrictions
Emergency response procedures	Understanding safety signs and Warnings
Heat stress precautions	Work permits
Hydrogen sulfide (H_2S) safety	

8.3 Short Service Employee (SSE) Program

A. Contractor shall establish a short service employee (SSE) program. This program shall include identification of new or inexperienced personnel so others may take extra care in their presence and provide additional assistance.

B. The SSE program shall define the criteria for an inexperienced worker based on duration of employment, change of job scope and/or length of industry service.

C. All new or inexperienced workers shall be classified as a SSE for a predetermined duration (e.g., 3-6 months) and shall be assigned a mentor during this time.

D. All SSE's shall continuously wear a visual identifier while at the job site (e.g., orange hard hat). The SSE visual identifier to be used shall be approved beforehand by the SAPO.

E. Before work commences, contractor shall inform the SAPO of the maximum ratio of SSEs to experienced workers that will be present at the job site at any given time. The SAPO reserves the right to require an alternate maximum ratio of SSEs.

F. Supervisors shall observe their SSE's work performance until they are satisfied that the employee can perform his job in a safe and effective manner.

G. The SSE program shall provide additional training as requested by the supervisor.

8.4 Job-Skills/Craft Competency Training and Safety Training

A. Contractor shall ensure that job-skills/craft and safety training fully qualify personnel to perform their job properly and safely.

B. Job-skills/craft competency training and safety training shall include, but not be limited to, the relevant topics listed in Table 8.2, depending upon the job scope and assigned responsibilities.

Table 8.2 Job-Skills/Craft and Safety Training Topics

Job-Skills/Craft Training	Safety Training
Abrasive blasting	Basic life support (BLS)
Asbestos	Communications
Cartridge operated tools (Hilti)	Compressed gas cylinders
Concrete formwork/shoring	Confined space entry/rescue
Cranes and rigging	Emergency response procedures
Cutting, welding, brazing	Fall prevention/protection
Demolition	Falling object prevention/protection
Electrical systems/equipment	Fire prevention/firefighting
Elevating/lifting equipment	First aid
Excavations and shoring	Hazard recognition
Explosive materials	Hazardous chemicals
Gas testing	Heat stress
Hand tools and power tools	Housekeeping
Heavy equipment	Hydrogen sulfide (H_2S)
Hydrotesting	Incident reporting/investigation
Ionizing radiation	Isolation/lockout/hold tag
Isolation and blinding	Job safety analysis (JSA)
Non-destructive testing (NDT)	Ladders
Painting and coating	Materials handling
Piling	Personal protective equipment (PPE)
Pipefitting	Respiratory protection
Plumbing	Vehicle/traffic/driving safety
Portable power tools	Work over water
Pressure testing	Work at heights
Scaffolding	Work permits

C. Contractors shall maintain training records for review by the SAPO upon request.

D. SA reserves the right to test/verify the job skills/craft competency and qualifications of contractor's employees and to remove any employee failing this test/verification.

E. Safety training shall also address off-job hazards (e.g., seat belt use, cooking safety).

8.5 Refresher Safety Training

Refresher safety training shall be:

- Conducted at a frequency not less than that established by Saudi Arab Government regulations or SA requirements (note: in the event that refresher safety training is not covered by Saudi Arabian Government regulations or SA requirements, the SAPO or contractor shall document the refresher safety training frequency).

- Documented by the contractor, including the personnel that attended and passed refresher safety training.

8.6 Safety Training for Site Supervision and Safety Staff

A. Contractor shall ensure that all their site supervision and safety staff receive formal safety training, including a 24-hour (min.) OSHA, NEBOSH, NSC or other SAPO-approved equivalent safety training program. This training shall include a review of typical site hazards and safe work practices.

B. Contractor's site supervision and safety staff shall be trained in, but not be limited to, the following:

- The job-specific CSSP and HIP.
- The contract's safety requirements.
- Specific hazards and safe work practices associated with the job.
- Relevant sections of the SA *Safety Handbook* and the SA *Construction Safety Manual* (CSM).
- Injury/incident reporting and investigation.
- Applicable emergency response procedures.
- First aid and basic life support (BLS). Note: They shall have valid first aid and BLS certificates in their possession at all times.

9.0 Medical

9.1 General

Contractor shall provide for medical care of its employees according to requirements established by the Saudi Arabian Government Ministry of Health (MOH) and Saudi Arabian labor law, GI 150.002, the SA *Minimum Medical Standards Requirements* (MMSR) Manual and in accordance with this section. This medical care shall include, but not be limited to, first aid, urgent and emergency care, stabilization and immediate transfer of patients to hospital, inpatient/outpatient hospitalization and emergency and disaster response. Following is a summary of some of the requirements from the MMSR manual.

9.2 Provision of First Aid

A. First aid, which is the immediate help provided at the work site to injured or seriously ill personnel prior to the arrival of professional medical assistance, shall be in strict compliance with the minimum requirements specified in Category D Facilities (Section 4) of the MMSR manual.

B. Contractor shall provide and maintain adequate first aid supplies for contractor and subcontractor personnel at all work locations per GI 150.002 and as follows:

- If fewer than 50 people are at a work site, provide at least one 10-unit first aid kit/cabinet. See GI 150.002 and the MMSR manual, Attachments 23 and 24, for the required contents of a 10-unit first aid kit/cabinet.
- If 50 people or more are at a work site, provide at least one 36-unit first aid kit/cabinet. See GI 150.002 and the MMSR manual, Attachments 23 and 24, for contents.
- If work is carried out at locations that are more than 300 m (1,000 ft) apart, a separate first aid kit/cabinet shall be provided for each group of workers.
- The contractor shall assign first aid attendant(s) to be responsible for each first aid kit/cabinet and to ensure there is sufficient stock of all supplies at all times.
- Signs/notices shall be posted near each first aid kit/cabinet stating the following:
  - Name of person(s) who is in charge of the first aid kit/cabinet.
  - Hospital where injured/ill personnel are to be transported.
  - Telephone number(s) of doctor(s) or first aid attendant(s).
  - Emergency telephone number(s).

C. First aid supplies shall be kept readily available in a first aid kit/cabinet designated for those supplies only. First aid supplies shall be kept in a sanitary condition at all times.

D. Contractor shall provide an adequate number of personnel at each work site who are trained in first aid and BLS, including those in charge of first aid supplies. See GI 150.002 for training requirements.

E. One four-wheel drive vehicle equipped with a well-stocked first aid kit for each crew shall be available for personnel performing pipeline or power-line work, or who are working in remote areas. These vehicles shall be marked to indicate they carry a first aid kit. A minimum of one person in every remote area crew shall have a valid first aid/BLS certificate.

F. A medical logbook shall be maintained at each first aid station and medical facility by the first aid attendant who shall log all injuries/illnesses treated. See the MMSR manual for a sample log.

G. Contractor shall provide Automated External Defibrillators (AEDs) as required by GI 150.002 and the MMSR manual. At each site with an AED, contractor shall provide an adequate number of personnel who are trained in AED operation.

9.3 Work Site Medical Facilities (Clinics)

A. Contractors employing more than fifty (50) total people for a given project (whether working on multiple shifts or not), including personnel employed

by the contractor's subcontractors, shall contractually arrange with a SA medical designated facility (MDF), or other medical facility recommended in writing by the SA Medical Services Organization (SAMSO), to establish, supply, staff and operate one or more work site medical facilities (clinics) as required by the MMSR manual.

B. Work site medical facilities (clinics), as defined in the MMSR manual, shall be either:

- Category A (Physician operated – Large).
- Category B (Physician operated – Small).
- Category C (Nurse operated).

C. The category of a work site medical facility (clinic) shall be in accordance the Initial Category/Level Evaluation Form (Section 2) in the MMSR manual, which is based on the following criteria:

- Number of personnel at the work site.
- Remoteness of the work site and access to definitive medical care (e.g., hospital).
- Potential risk factors at the work location.
- Specialized services required (medical procedures, diagnostics or otherwise).

D. If approved in writing by the SAPO, the contractor for a non-construction contract is not required to provide a work site medical facility (clinic) for office personnel (e.g., working in an office building within a major metropolitan area) if the contractor has contractually arranged for emergency response and medical care with a nearby hospital that is operated 24-hours a day, seven days a week and is capable of responding to the office building within a maximum travel time of ten (10) minutes.

E. Work site medical facilities (clinics) shall be fully established and in operation before work begins and shall:

- Have the capability to provide first aid, urgent care, prehospital and resuscitation care, stabilization and prompt transfer to the nearest hospital.
- Have a building that complies with the building specifications and acceptable floor configurations in the MMSR manual. The floor plan and specifications of all new work site medical facilities (clinics) shall be submitted to the SAPO and approved by SA prior to use.
- Have an emergency response plan (ERP) detailing the response capabilities specific to the geographical location. A medical emergency and disaster call-out list shall be posted in the work site medical facility (clinic). Each facility shall have at least one emergency response bag as specified in the MMSR manual.

F. The contracted MDF or other medical facility shall provide, in addition to qualified manpower (see Section 9.4) and proper supplies, all medical services required to operate the work site medical facility in accordance with the MMSR manual. This operation shall include, but not be limited to, providing the following services: clinic supervision, medical referral and consultation, pharmaceutical (drug formulary, storage, administration, dispensing and disposal), medical equipment and equipment maintenance, medical transportation, emergency/disaster response planning and training, healthcare policies and procedures, and other needed general and technical medical support services, including medical training to the contractor's employees.

G. Contractor shall make arrangements to have each work site medical facility (clinic) independently inspected/audited prior to startup and at least semiannually thereafter. These inspections/audits shall be performed by medically qualified personnel from the contracted MDF or other medical facility used by the contractor for its work site medical facilities (clinics), but shall not be personnel who staff the specific work site medical facility being inspected/audited.

H. These inspections/audits shall use the Survey and Compliance Review Report (Sections 3 and 4) in the MMSR manual, including during initial setup of a medical facility (clinic). The clinical and technical parts of the survey shall be performed by medically qualified personnel. The contractor shall be responsible for promptly correcting all deficiencies or violations identified by any such inspections/audits. Initial and periodic inspections/audits shall cover all areas mentioned in this Section 9.0 and the MMSR manual, including:

- General health care requirements.
- Building specifications.
- Manpower requirements.
- Staff qualifications, continuing education and training.
- Safety, environmental, health and infection control requirements.
- Medical equipment and supplies.
- Pharmaceutical Services.
- Support services (communications/ambulance/janitorial services).
- Medical emergency and disaster response procedures/Medevac procedures.
- Health care policies, procedures and scope of service.
- First aid kit/cabinets required, including an Automated External Defibrillator (AED).

I. Contractor shall ensure that drug formulary, prescription, supplies, storage, administration and dispensing shall be under the supervision of a licensed

pharmacist or physician from the contracted MDF or other medical facility used by the contractor for its work site medical facilities (clinics).

J. Contractor shall ensure it has or has arranged to have in place the necessary support services required to comply with the requirements in the MMSR manual, including safety, environmental health and infection control (e.g., disposal of medical waste), equipment management, janitorial services and communication services.

K. Work site medical facilities (clinics) shall be subject to inspection by SA. The contractor shall be responsible for promptly correcting any deficiencies or violations identified by SA following any such inspections/audits.

9.4 Medical Professional Personnel

A. Contractor shall contractually arrange with a SA-contracted MDF, or other medical facility recommended in writing by SAMSO, to provide qualified medical professional personnel as per the MMSR manual to staff each work site medical facility (clinic).

B. Medical professional personnel (e.g., physicians, nurses) shall at a minimum meet the licensing requirements of the Saudi Arabian Government MOH Saudi Council for Health Specialties (SCFHS) and shall possess the necessary experience, training, minimum qualifications and required certifications as specified in the MMSR manual.

C. The names, qualifications and MOH certificates of the medical professional personnel who will staff a medical facility (clinic) shall be submitted to the SAPO for review before work begins.

D. Contractor shall have arrangements in place with the contracted MDF or other medical facility used by the contractor for its work site medical facilities (clinics) to provide medical professional personnel coverage for unplanned emergencies, holidays, sickness, off-duties, absences and other unplanned events.

E. Medical professional personnel shall be provided with periodic mandatory and continuing education by their employer as required by the MOH. This continuing education shall include, but not be limited to: first aid/BLS, safety and infection control, heat stress, fire and disaster training, etc.

F. Contractor shall make arrangements with the contracted MDF or another medical facility (e.g., hospital) for consultation services so a qualified physician (specialist or otherwise) can be consulted by the work site medical facility's staff 24 hours a day, seven days a week for medical advice, prescription of drugs, referral and/or transfer of patients as needed.

G. All medical professional personnel shall receive disaster training at least annually. Training shall include the application of the commonly used

triage system in disaster management, communication strategies and participation in at least two disaster drills per year.

9.5 Medical Insurance and Ambulance(s)

A. To facilitate and expedite patient transfer and admission to a nearby hospital for definitive care and to comply with the Saudi Arabian Government's medical insurance laws, contractors shall ensure all their employees, including subcontractor employees, are continuously provided with valid medical health insurance coverage, before they enter the work site, for outpatient, first aid, emergency, specialist and inpatient care at a nearby hospital that is operated 24-hours a day, seven days a week. Contractor shall submit documentary evidence of current medical health insurance coverage for its employees to the SAPO monthly and upon request.

B. Contractors shall provide or make arrangements to provide a dedicated, full-size emergency vehicle (ambulance) at each work site medical facility (clinic) to transport injured/ill personnel to the nearest hospital. If the work location is off road, the contractor shall provide a four-wheel drive ambulance.

C. Ambulances shall comply with the vehicle specifications in the MMSR manual and shall be maintained in a safe, clean, sanitary and roadworthy condition in compliance with Saudi Arabian Government regulations and SA vehicle requirements. Ambulances shall be provided with a dedicated shaded parking space.

D. Ambulances shall have purpose markings, be configured safely and be equipped, at a minimum, with emergency and resuscitation supplies as specified in the MMSR manual.

E. A daily ambulance log and ambulance preventive maintenance work sheet shall be maintained (see the MMSR manual for samples).

F. Contractors shall provide ambulance drivers with first aid/BLS training, site orientation and medical facilities location training.

G. Ambulance drivers shall be qualified as per the MMSR manual and shall have a valid Saudi Arabian Government driving license.

9.6 Air Medical Evacuation (Medevac)

A. Contractor shall ensure that needed Medevac procedures are incorporated into their emergency response procedures as a part of their CSSP.

B. Procedures to initiate a Medevac are in GI 1321.015.

10.0 Site Planning, Usage and Housekeeping

10.1 Initial Site Planning

A. Prior to start of on-site work, the contractor shall determine what personnel, equipment, procedures, etc., will be needed and how they will be provided in order to ensure that the work will be conducted in a safe manner.

B. The contractor's initial site planning shall consider, but not be limited to, the following topics:

- Site location—offices, worker camps, etc. (see Sections 10.0 and 11.0).
- Heavy equipment, chemicals, demolition, welding, nondestructive testing (NDT), etc.
- Personal protective equipment (PPE).
- Emergency response procedures.
- Work permit requirements.
- Control of falling objects.
- Required barriers.
- Medical and first aid resources needed (see Section 9.0).
- Heat stress management and prevention.
- Fire/drinking/sanitary water supply and distribution.
- Transportation (see Section 4.15).
- Excavations.
- Electrical tools and services.
- Scaffolding and work at heights.
- Safety staff (see Section 4.5).

Note: Some of the above topics are covered in further detail elsewhere in this manual.

10.2 Site Planning and Layout

A. Site planning shall include, but not be limited to: building spacing, fire protection, welfare facilities, rest areas, recreational facilities, assembly areas, offices, living quarters, medical facilities, dining facilities, prayer areas, laydown yards, fabrication shops, etc.

B. The site layout shall be planned before mobilization to the work site to identify issues such as, but not limited to: emergency access routes, normal traffic flow, parking areas, siting for cranes, staging areas, material storage, sanitation/welfare facilities, first aid stations/medical facilities, fixed/portable fire protection, utilities, etc.

C. Access road planning shall include, but not be limited to: traffic flow, load-bearing capacities, traffic signs and controls, road striping, parking areas, road intersections and multiple-use roads. Emergency response vehicle access shall be provided at all times to all locations.

D. Contractor shall provide adequate shelters/rest facilities and drinking water supply at construction sites and work locations, including as needed for prevention of heat stress.

10.3 Plans for Contractor Camps and Project Support Facilities

A. Contractor shall prepare comprehensive plans for all contractor camps and project support facilities that incorporate the requirements from the above planning and are in accordance with Section 11.0. These plans shall address, at a minimum, the following as applicable to the contract:

- Plot plans and building layouts, which for contractor camp facilities shall show the camp site layout including medical, dining, recreation and toilet/shower facilities.
- Interior building layout/space utilization, which shall show site offices, conference rooms, prayer rooms, open office space for clerks, partitioned office spaces, kitchens, storage areas, etc. For contractor camps, interior building layouts shall show dormitory room planned occupancy and furniture layout.
- Building architectural/structural design features, including materials of construction.
- Building fire protection and alarm systems.
- Blast resistance features (if located within a blast hazard zone as per SAES-B-014).
- Building air-conditioning, heating and ventilation distribution systems, including temperature control and equipment sizing calculations.
- Electrical power distribution systems.
- Electrical outlets per room (number and location shall be sufficient to safely accommodate personal electronics needs, such as TVs, mobile phone chargers, radios, etc.).
- Building and area lighting.
- Communications systems, data cabling and equipment.
- First aid, ambulance and medical services/clinics.
- Fire prevention and fire fighting provisions.
- Raw water treatment and drinking water supply.
- Sewage/waste water collection, treatment and disposal.
- Sanitation plan, including refuse handling requirements and waste management facilities.

- Storage, shop, fabrication areas.
- Roads and parking areas.
- Provisions for vehicle repairs, service and maintenance.
- Site lunch shelters.
- Site security fencing.

B. Contractor shall submit three copies of all contractor camp and project support facility plans to the SAPO for review within fifteen (15) working days of contract execution. Construction shall not start on the contractor camp or project support facility until the plans have been reviewed and approved per GI 298.010.

10.4 Land Use Permit

A. Whenever a contractor camp or project support facility is needed, the contractor shall obtain, through the SAPO, any required land use permit (LUP) prior to the commencement of any work activity at the site.

B. The LUP application shall be in accordance with GI 2.716 and GI 2.718. The LUP application (SA Form 8037) shall specify the maximum number of occupants and shall include plans of the proposed contractor camp and project support facilities, as specified in Section 10.3.

C. Contractor shall comply with all conditions stated on the SA LUP.

D. If required, a letter of understanding per GI 2.718 for contractor site allocation shall be signed by contractor and contractor shall comply with all conditions stipulated therein.

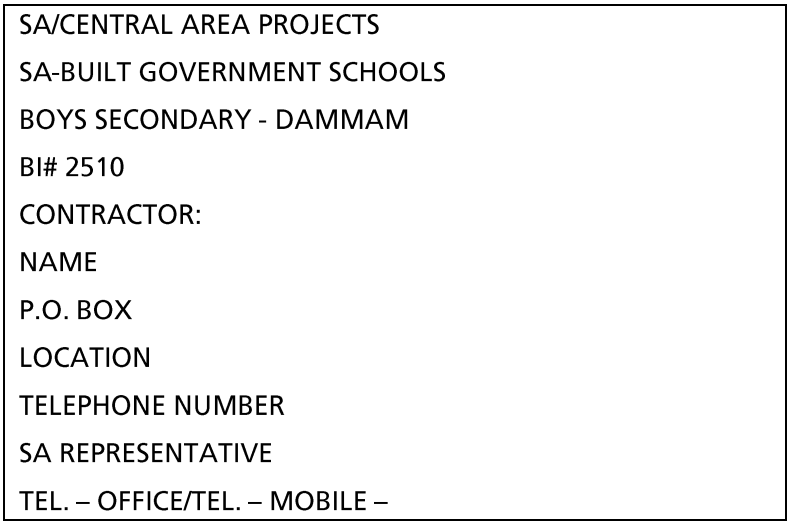
10.5 Project Signs

A. A job activity information sign (e.g., see Figure 10.1 below) shall be erected at the main entrance(s) to the job site and shall comply with the requirements of this section.

B. At a minimum, the following information shall be shown on project signs:

- SAPO name.
- Project title.
- Budget item (BI), job order (JO) or contract number.
- Prime contractor name, address and telephone number.
- Emergency contact numbers for SAPO and contractor representatives.

Figure 10.1 Example Job Activity Information Sign



C. The design of project signs shall be:

- A minimum of 1.2 m (4 ft) high and 2.4 m (8 ft) wide.
- Printed in black and white.
- Printed in Arabic and English, with the Arabic text located above or to the right of the English text.

D. Sufficient signs shall also be erected and maintained on or near the site to direct delivery vehicles and visitors to the work area.

E. Other signs, such as safety warnings, may be required (e.g., by the SAPO).

10.6 Entry and Exit

Safe entry and exit points shall be provided at work sites. Entry and exit points shall be kept clear and unobstructed at all times.

10.7 Pedestrian Pathways On-Site

On-site dedicated pedestrian walkways/pathways shall be clearly marked and distinct from vehicular travel routes. Physical barriers shall separate parallel personnel walkways/pathways from adjacent vehicular and heavy equipment traffic.

10.8 Barricades

Barricades shall be provided where required. Barricades shall be clearly marked with flagging. Barricades shall have protective lighting, when necessary.

10.9 Site Drainage

Sites shall have good drainage and be graded so water does not pool on job sites, camps, roads, etc.

10.10 Fire Protection and Prevention

A. Contractor shall provide firefighting equipment (e.g., fire extinguishers, hydrants, hoses, sprinklers, alarms) as specified in SAES-M-100, or if applicable, SAES-B-019. See Section 11.6 for fire water system requirements, as applicable.

B. Firefighting equipment shall be readily available and accessible. Areas around fire extinguishers, hydrants, hoses and other firefighting equipment shall be kept clear.

C. Fire extinguishers, hydrants, hoses and other firefighting equipment shall be regularly inspected (i.e., per GI 1781.001) and maintained. Contractor shall provide fire equipment inspection and maintenance records to the SAPO upon request.

D. Designated site personnel shall be trained in the use of the various types of firefighting equipment on-site. See Chapter I-7, *Fire Prevention*, of the CSM for further details.

E. Smoking shall be permitted only in designated areas.

10.11 Materials Storage Yards

A. Flammable and combustible material storage areas within materials storage yards shall be clearly marked and adequate in size and layout.

B. Material storage yards shall not be closer than 15 m (50 ft) to any other structure.

C. For further information, see Chapter I-12, *Materials Handling*, of the CSM (including an example of a proper material storage yard layout drawing).

10.12 Site Illumination and Electrical

A. Adequate lighting shall be provided per SAES-P-123.

B. Grounding for electrical tools and wiring installations shall be in accordance with SAES-P-111.

C. Contractor shall comply with the National Fire Protection Association, NFPA 70, *National Electrical Code (NEC)*, and SA's electrical safety requirements.

10.13 Security Fencing

A. Contractor shall provide, install and maintain required temporary security fencing in accordance with SA requirements (e.g., SAES-M-006).

B. Fences shall be properly designed, grounded, of sound construction, appropriate for the intended purpose and built in accordance with SA requirements (e.g., SA standard drawing AB-036677, "An Overview [Architectural] Saudi Aramco Security and General Purpose Fencing").

C. Fences shall be periodically inspected.

D. Existing roadways and pedestrian walkways crossing the work site shall be rerouted outside the work site perimeter fence prior to the start of work.

E. Red and white, blue and white, or black and reflective yellow (or white) flags shall be fastened to the fence when a fence crosses an existing road.

F. Dead-end signs shall be erected on the approach to fences if access is blocked. The distance to the blocked access shall be noted on the sign. However, if there is a temporary bypass, a "DIVERSION AHEAD" sign, with diversion arrows showing the proper route, shall be erected on the approach to the fence in black and yellow (or white) reflective material.

G. At least two access gates 4.5 m (15 ft) wide, located at opposite ends, shall be provided to the site. Access gates, where possible, shall avoid opening onto main thoroughfares.

H. Standard Saudi Arabian Government-compliant stop signs shall be attached to vehicle access gates.

I. Temporary signs shall be erected to route traffic in the safest manner to, from and within the site. Temporary signs shall not be placed on public highways and roads (refer to Saudi Arabian Government traffic regulations).

10.14 Securing Site and Equipment after Working Hours

A. Power-driven construction equipment shall have the ignition locked and key removed when not in use.

B. Heavy equipment that will be left unattended overnight shall be made immobile by disconnecting the battery or by other appropriate means if there is no lock for the cab and the engine compartment access is readily available.

C. Bulldozer blades, front loader and backhoe buckets and similar pieces of equipment shall be lowered to the ground when not in use.

D. Excavations or obstructions creating hazards to pedestrian or vehicular traffic at night shall have adequate lighting. Warning signs shall be posted on approved types of barricades (see GI 1021.000).

E. Contractor shall provide night watchmen and security personnel as needed to control access to the site after hours.

10.15 Manholes and Covers

Open manholes and openings in grating on elevated levels shall be properly barricaded. Hard barricades and warning signs shall be installed prior to removing a manhole cover or grating. Manhole and grating shall be immediately put back in place upon completion of the work activity.

10.16 Guy Lines/Ropes

Temporary guy lines and barrier ropes shall be clearly marked with reflective tape and/or signs and barricades provided to protect them, when needed.

10.17 Road Closures

Road closures shall be performed in accordance with Saudi Arabian Government regulations and SA requirements, including GI 1021.000.

10.18 Dust Control

A dust control program shall be identified in the HIP, developed and implemented to protect personnel and the general public.

10.19 Protection of the General Public

The general public shall be protected from exposure to hazards associated with the contractor's work activities such as, but not limited to, abrasive blasting, radiation, painting, excavations and traffic routing.

10.20 Housekeeping

A. Contractor shall provide for:

- Cleaning of the entire site, including identifying areas where each subcontractor is responsible for the cleaning.
- Collection, storage and disposal of nonhazardous and hazardous waste in accordance with GI 430.001.
- An adequate amount of trash receptacles in work areas.
- Keeping waste segregated at all times in accordance with waste handling requirements (see GI 430.001).

B. The contractor's site supervision shall ensure that trash and debris is properly collected and disposed of daily.

C. Trash containers shall be of durable construction and shall be located as needed throughout the work area. Trash containers shall be covered, clearly marked and emptied daily. Separate trash containers, with suitable disposable plastic liners, shall be provided for food scraps and other organic matter.

D. Refuse, trash and garbage shall only be disposed of at approved sites as designated by SA or local municipality.

E. Excavation spoils and building materials shall only be disposed of at other approved sites as designated by SA or local municipality.

F. Contractor shall establish a site-specific waste management plan, which shall include specific procedures for disposal of any hazardous wastes (e.g., waste oil, sewage, naturally occurring radioactive materials [NORM]), in accordance with Saudi Arabian Government regulations and SA Environmental Protection Department (EPD) requirements. Contractor shall submit their site-specific waste management plan to the SAPO for review. The SAPO reserves the right to forward a copy of the waste management plan to EPD for review.

11.0 Contractor Camps and Project Support Facilities

11.1 General

A. Contractor shall ensure contractor camps/compounds and project support facilities (e.g., site offices, storage/laydown yards, fabrication/maintenance shops, medical/clinics) that are provided for contractor's personnel, subcontractors' personnel and/or SA employees comply with the provisions of the Saudi Arabian Labor and Workmen Law and SA's safety, health and environmental requirements, including Section II of Schedule "D", the SA Sanitary Code (SASC) and GI 151.006.

B. SA will inspect and periodically reinspect any contractor camp, other project support facility or work site, on or off SA property, for compliance with applicable laws and SA's safety, health and environmental requirements. Corrective actions shall be taken as noted.

C. Contractor camps and project support facilities shall be located so as to minimize exposure to hazards (e.g., located upwind from process areas and well sites), including traffic hazards to work site(s). SA shall approve the location of contractor camps and project support facilities prior to their construction, as per Section 10.4.

D. Buildings, including portable buildings, are not allowed within 500 m (1,640 ft) of a plant perimeter fence, pipeline corridor or well site without SA's written permission. See SAES-B-014, SAES-B-055, SAES-B-062 and SAES-B-064 for additional facility siting requirements.

E. Contractor shall furnish, install and maintain a fire alarm system for all contractor camp and project support buildings as required by SAES-M-100.

F. Contractor shall provide designated outdoor smoking facilities within contractor camp and project support facilities. Only smoking facilities approved by the SAPO shall be used by workers on jobs located within a SA plant or hazardous area.

G. Contractor shall provide, install, operate and maintain potable water supply and distribution system(s) in accordance with Section 01, *Water*, of the SA Sanitary Code (SASC). Potable water systems shall have sufficient storage capacity for providing acceptable potable water supply as required for contractor camp and project support facilities, as well as at construction sites and other work locations. Potable water shall have a residual chlorine level of between 0.5 ppm minimum and 3.0 ppm maximum. See Section 11.7.

H. Prior to occupancy and connection of utilities, contractor camp and project support facilities shall be subject to inspection by the SAPO, LPD, Fire Protection Department, Inspection Department (electrical, mechanical, plumbing), EPD, SAMSO, and shall meet all applicable safety, fire and health standards. Any concerns generated during the inspection or otherwise brought to the attention of the contractor shall be promptly and satisfactorily resolved prior to occupancy.

I. For contractor camps and project support facilities, a dedicated and properly trained maintenance crew shall be available 24 hours per day. The names and contact information for these maintenance personnel shall be prominently displayed within the camp/facility.

J. High risk maintenance activities (e.g., confined space entry, electrical isolation, rigging and lifting) at contractor camps and project support facilities shall be controlled (e.g., by developing JSAs, using work permits, or issuing procedures).

11.2 Contractor Camp General Requirements

A. Contractor shall design and construct structures and buildings to meet the requirements of SAES-M-100.

B. Contractor shall provide a camp(s) to adequately house anticipated staff and labor force. Depending on the nature of the contract these camps may also house SA and subcontractor personnel in addition to contractor personnel.

C. Contractor shall operate and inspect (with corrective actions), manage and maintain accommodation camps so as to ensure an acceptable standard of living, including proper facility maintenance, hygiene standards, fire and life safety, pest control and food safety in accordance with SAES-M-100, SASC-S-07 (*Camps and Communal Living Facilities*), and the contract.

Facilities for sleeping, dining, medical, firefighting, sanitation and recreation, as well as barber shops, bakeries, grocery/convenience markets, cleaning/laundry services, etc., shall be provided in accordance with the requirements of this document, SAES-M-100, SASC-S-07, and the contract.

D. Sleeping and living areas within contractor camps shall be air-conditioned and periodically maintained on at least a biannual basis in accordance with the manufacturer's recommendations. The contractor shall submit to the SAPO a copy of the maintenance records, upon request.

E. Contractor camps shall include a fully equipped kitchen(s) and dining room(s) suitable for the preparation of high-quality meals per Section 07 of the SASC. Dining facilities shall be provided with tables, chairs, utensils and cutlery.

F. Personnel housed in the contractor camp shall be provided with three ample and well-balanced meals per day.

G. Cooking shall not be allowed within contractor camp accommodation rooms per section 07 of the SASC. Use of hot plates, stoves, portable ovens, open-flame burners, etc., shall only be permitted in designated kitchen and break room areas. Use of smoking materials, including cigarettes, cigars, pipes, etc., and burning of candles, incense, etc., shall not be allowed inside any building.

H. Camp food establishments, grocery/convenience markets, etc., shall not sell raw meats, cooking oil, cooking pots and pans, cooking burners, hot plates or other food items and equipment that would enable camp residents to cook in their own rooms.

I. All buildings, including portable buildings, shall be equipped with hand-held fire extinguishers as per SAES-M-100 and SAES-B-019, as applicable.

J. Any personal electrical items offered for sale to camp residents (e.g., in a camp grocery market or convenience store) or used in the camp shall be labeled as meeting CE, Underwriters' Laboratories (UL) or Factory Mutual (FM) requirements (or equivalent as specified in writing by the SA Loss Prevention Department).

K. Contractor camps and project support facilities shall include adequate purpose-designed lighting for all streets, parking areas, sidewalks and around buildings and outdoor facilities.

L. Contractor camps and project support facilities shall be adequately drained on and away from the site.

M. Contractor camps and project support facilities shall include paved/designated streets and parking areas with a properly prepared and compacted base. Speed bumps/dips shall be installed on streets as required

for pedestrian safety. The camp/support facility shall include paved/designated sidewalks for all areas to be utilized as pedestrian walkways and shall include small diameter crushed stone as ground cover in unpaved areas around all buildings.

11.3 Minimum Safety Standards for Contractor Camp Buildings and Project Support Buildings

A. The minimum clear spacing between non-combustible buildings larger than 548 m^2 (5,900 ft^2) and/or between clusters of smaller buildings totaling more than 548 m^2 (5,900 ft^2) shall be 6.1 m (20 ft). The minimum clear spacing between smaller buildings and buildings within a cluster shall be 1.8 m (6 ft). The minimum clear spacing from perimeter fences to buildings shall be 3 m (10 ft). See SAES-M-100.

B. The building's structural design shall be for applicable loads and in accordance with SAES-M-100, including wind loads per SAES-A-112. Building frames shall be supported on concrete footings.

C. Camp accommodation rooms shall have not less than 4.6 m^2 (50 ft^2) of air-conditioned living area per person, preferably at least 6.5 m^2 (70 ft^2) per occupant.

D. A separate bed shall be provided for each camp occupant. Triple deck bunk beds are not permitted.

E. Sleeping rooms shall have an emergency egress opening, which can either be an outward opening mandoor or a window that opens to the outside. Emergency egress openings shall comply with SAES-M-100 and shall be operational from inside the room without use of keys or tools. All operable windows in accommodation rooms shall be provided with an insect screen.

F. Newly installed, relocated or renovated contractor camp buildings and project support buildings, including portable buildings, provided for SA and/or contractor/subcontractor personnel shall comply with SAES-M-100 as explained in the SA Safety Management Guide, *Application of Saudi Aramco Building Code to Contractor Camp and Project Support Buildings*.

G. Any newly installed, relocated or renovated building, whether portable or fixed, that is located in a zone predicted to receive at least 3.5 kPa gauge (0.5 psig) peak side-on overpressure from a vapor cloud explosion shall be designed and constructed in accordance with SAES-B-014.

H. Pre-engineered modular buildings meeting SAES-M-100 equivalent standards of quality, durability, safety, sanitation and reliability may be proposed by the contractor for consideration by the SAPO. Proposals for pre-engineered modular buildings shall include the manufacturer's name, address, phone/facsimile numbers, Internet Web site address and sufficient product information to enable the SAPO to evaluate the suitability of such structures.

I. Pre-engineered modular buildings shall meet the following minimum requirements:

- Welded steel skids or attached running gear.
- 100 mm (4 inches) minimum wall thickness.
- Fully insulated walls and ceilings.
- Metal or other nonflammable roof materials.
- Suspended ceiling completely wired and plumbed with concealed wiring and plumbing.
- Built-in circuit breaker panel and exterior electrical connection.
- Ground fault circuit interruption (GFCI) devices on all electrical outlets within 1.8 m (6 ft) of a water source (e.g., sink, tub, toilet, shower, etc.).
- Air conditioning and heating with individual controls to maintain temperature between 21 and 24 °C (70-75 °F).
- Offices with full height walls shall be lockable and have windows facing the outside of the building with blinds.

J. External egress doors shall swing outward and shall be provided with panic push bars as required by SAES-M-100. Internal doors shall be painted solid core with frame and door stopper.

K. Buildings and structures shall be electrically grounded. Metal enclosures of power distribution panel boards shall be connected to a grounding system.

11.4 Welfare/Sanitation Facilities

A. Contractor shall provide welfare facilities (e.g., toilet/washing facilities) for personnel at contractor camps, project support facilities and other work sites in accordance with GI 151.006 and Section 07, *Camps and Communal Living Facilities*, of the SASC.

B. Toilet facilities shall include western- and eastern-style toilets, urinals, ablution hoses, sinks, water heaters, air extractors, mirrors, toilet paper holders, paper towel holders, soap dispensers/dishes, coat hooks and garbage bins.

C. Toilets shall be provided, as a minimum, according to Section 07, Table 2, of the SASC.

D. Toilet facilities shall be easily accessible and shall be of durable and hygienic construction consistent with their purpose and shall have adequate lighting, ventilation and a continuous supply of water.

E. Washing facilities shall be provided in accordance with GI 151.006 and the SASC.

F. Toilets and washing facilities shall be continuously maintained in a clean and sanitary condition.

G. Potable (fresh) drinking water shall be readily available. Contractor shall provide conveniently located bottled drinking water dispensers. Only water bottles with tops that have been sealed by the supplier shall be used (i.e., bottles shall not be refilled except by the bottle supplier). Water bottles shall be routinely changed and all water dispensers shall be frequently cleaned to maintain a sanitary and fresh supply of drinking water in each dispenser. Common drinking cups or dippers are prohibited. Disposable paper cups or other separate cups shall be provided for each person.

H. Sun-protected rest areas shall be provided and shall be away from operating equipment and work areas.

11.5 Electrical Power Generation and Distribution Systems

A. Contractor shall provide, install, operate and maintain power generation and distribution facilities at contractor camps, project support facilities and worksites, as needed.

B. The power system shall provide electrical power supply at 110 volts/60 Hz, on a 24 hour per day, 7 days per week basis, or as needed.

C. Power distribution panel boards shall be labeled to identify the service of individual breakers.

D. The entire electrical installation shall comply with the U.S. National Electrical Code (NEC) and be tested at least annually by a qualified electrical engineer from an independent source. The contractor shall submit to the SAPO a copy of the electrical test certificate, upon request.

11.6 Fire Protection Systems

A. Contractor shall design, install and operate a fire water system(s) with sufficient storage capacity to provide full fire protection coverage. Design plans for fire protection systems shall be submitted to the SAPO for review.

B. Inspection, testing and maintenance of fire alarm and protection systems, including sprinklers and portable fire extinguishers, shall be in accordance with GI 1781.001.

C. Dedicated fire water storage capacity shall not be used for any other purpose (e.g., drinking, bathing, ablution).

11.7 Raw Water Treatment and Drinking Water Supply Facilities

A. Contractor shall provide, install, operate and maintain all required raw water treatment facilities, potable water distribution systems, drinking

water supply systems within the contractor's and subcontractor's assigned areas in accordance with Section 01, *Water*, of the SASC.

B. Plans for raw water treatment and drinking water shall be reviewed by the SA EPD prior to construction.

C. Contractor shall ensure that the bacteriological and chemical qualities of the drinking water, including during transportation and storage, are in accordance with Section 01, Table 10, of the SASC.

11.8 Sewage and Solid Waste Management Facilities

A. Contractor shall provide, install, operate and maintain all required sanitary sewer systems at contractor and subcontractor assigned areas, including contractor camps and project support facilities, in accordance with Section 02, *Sanitary Wastewater and Sewerage Systems*, of the SASC. The contractor shall be responsible for installing all required sewage collection manholes and piping, etc.

B. Contractor shall remove all solid waste and debris from contractor camp and project support facilities on not less than a daily basis and dispose of it at a solid waste disposal facility approved by SA.

C. Plans for sewage collection, holding, treatment and final disposal and plans for solid waste management facilities shall be reviewed by the SA EPD prior to construction.

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Work Site Safety Manual (WSSM)
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1. Emergency Reporting and Response

1.1 Purpose

This chapter describes minimum requirements for emergency reporting, as well as for response actions during an emergency.

1.2 References

Saudi Aramco (SA) General Instructions (GIs):

GI 6.025, *Control of Remote Area Travel and Search/Rescue Procedures*

SA Safety Management Guide: Emergency Preparedness

SA Emergency Management Guide

SA Safety Handbook, *Minimum Safety Rules*

1.3 Emergency Response Plan

1.3.1 SA and contractor personnel shall be familiar with the following:

A. Specific facility emergency response plan.

B. Specific roles/responsibilities (e.g., for supervisors—to provide head counts).

C. Locations where resources are available.

D. Facility's audio and visual alarms.

E. Evacuation routes and procedures.

F. Assembly areas and shelters.

1.4 Emergency Reporting

1.4.1 All emergencies shall be reported immediately (e.g., to the nearest SA Security Main Gate or Security Control Center [SCC]).

1.4.2 Signs shall be conspicuously posted at the work site with the emergency telephone numbers and reporting instructions.

1.4.3 Reporting emergencies within Saudi Aramco shall be:

A. By telephone. Dial 110.

B. By radio. Radio an operations group that has a telephone and ask them to dial 110 if you cannot contact the Security Main Gate or SCC directly.

1.4.4 Reporting emergencies from outside SA shall be:

A. By cellular phone. Dial the following number depending upon the area:

- 03-872-0110 – Dhahran/Central Area
- 03-572-0110 – Abqaiq/Southern Area
- 03-673-0110 – Ras Tanura/Northern Area
- 01-285-0110 – Riyadh/Central Region
- 02-427-0110 – Jiddah/Yanbu/Western Region

B. By messenger. Send a messenger to the nearest telephone, radio, SA Security Main Gate or SCC to report the emergency.

1.4.5 When transmitting a message by telephone, radio or messenger, ensure the following information is provided:

A. Exact location (e.g., plant, building or house number).

B. Nature of the emergency (e.g., fire, explosion or gas release).

C. Type of service required.

D. Number of injured personnel.

E. Telephone number you are calling from, if available.

F. Caller's name and badge number.

Note: Stay on the telephone or radio until told to hang up. *Repeat the message if asked to do so.* If possible, post a lookout to direct the ambulance, fire truck, helicopter or other response vehicle to the right location.

1.5 Actions to be Taken During Emergencies

1.5.1 This section lists primary actions for personnel not involved with emergency response. Whether a responder or not, all personnel shall be knowledgeable of the minimum requirements that are specific to each operating facility/area during an emergency.

1.5.2 The actions that shall be performed by personnel not involved with emergency response that are common across all SA facilities/sites are as follows:

A. Upon hearing an emergency alarm, personnel shall:

- Stop all work immediately.
- Safely shut down all equipment.

- Evacuate to the predetermined assembly point.

B. Supervisors shall:

- Stop all work immediately and cancel work permits.
- Safely shut down all equipment.
- Evacuate all personnel to a predetermined assembly point or shelter area.
- Conduct a roll call or head count to account for every person. In the event a person is missing, his/her name and last known location shall be communicated to the Incident Commander immediately.
- Prevent personnel from returning to work until notification has been received from the SA proponent organization (SAPO).
- Revalidate all work permits prior to commencing work.

Contractors shall provide home and mobile telephone numbers (and those of replacements) to the SAPO for emergency contact after hours for incidents involving the contractor's job, personnel or equipment. These telephone numbers shall be kept current and posted at the job site.

2. Incident Reporting and Investigation

2.1 Purpose

This chapter describes requirements for reporting and investigating incidents that occur on Saudi Aramco (SA) property or on SA projects.

2.2 References

SA General Instructions (GIs):

GI 2.104, *Offshore Oil Spill Reporting Procedure*

GI 2.401, *Inland Oil Spill Response*

GI 6.001, *Notification Requirements for Incidents (Including Fires)*

GI 6.003, *Incident Investigation*

GI 6.004, *Near Miss Reporting Process*

GI 6.005, *Reporting, Investigation and Recording of Injuries/Occupational Illnesses*

GI 6.007, *Reporting of Contractor On-Job Injuries/Occupational Illnesses*

GI 6.029, *Reporting and Recording of Motor Vehicle Accidents*

GI 7.026, *Crane and Heavy Equipment Incident Reporting Procedures*

GI 155.003, *Form 3208, "Request for Medical Treatment of Injury or Occupational Illness"*

GI 1787.000, *Report of Fire, Emergency or False Alarm*

2.3 General Requirements

2.3.1 SA personnel/supplemental manpower shall immediately report to their supervisors:

A. All on-job injuries and occupational illnesses.

B. All fire, explosion and false alarm incidents.

C. All oil spills/leaks and gas leak incidents.

D. All crane and heavy equipment incidents.

E. All SA motor vehicle accidents (MVAs).

F. All incidents resulting in damage to SA equipment/assets.

G. All near misses, as determined by the SA proponent organization (SAPO).

2.3.2 SA supervisors shall:

A. Investigate the following:

- All on-job injuries and occupational illnesses.
- All fires, explosions and false alarm incidents.
- All oil spills/leaks and gas leak incidents.
- All serious near misses, as determined by the SAPO.
- All crane and heavy equipment incidents.
- All SA MVAs.
- All incidents resulting in damage to SA equipment/assets.

B. Begin the investigation process immediately after the incident and complete it as soon as practicable.

C. Complete and submit all injury data from the incident into SAP EH&S within one working day of the incident.

D. Submit an initial incident report within 24 hours of verbal notification.

E. Submit final incident investigation reports in accordance with GI 6.003.

2.3.3 Contractor personnel shall immediately report to their supervisor:

A. Job-related fatalities.

B. All on-job injuries and occupational illnesses.

C. Damage to property or equipment (e.g., cranes/heavy equipment, scaffold or excavation collapses).

D. All fires and explosions.

E. All oil spills/leaks and gas leaks.

F. All near misses.

2.3.4 The contractor supervisor shall immediately report to the SAPO all contractor and sub-contractor employees' on-job injuries or occupational illnesses, and MVAs utilizing the appropriate forms.

2.3.5 The contractor supervisor shall:

A. Submit to the SAPO all on-job incident reports.

B. Provide assistance to the SAPO's incident investigation team as deemed necessary.

3. Personal Protective Equipment (PPE)

3.1 Purpose

This chapter describes minimum requirements for selection and use of personal protective equipment (PPE).

3.2 References

Saudi Aramco (SA) General Instructions (GIs):

GI 2.721, *Electrical Arc Flash Hazard Mitigation*

GI 8.002, *Safety Spectacles*

GI 8.005, *Protective (Safety) Footwear*

GI 1780.001, *Atmosphere-Supplying Respirators*

SA Engineering Standard (SAES):

SAES-A-105, *Noise Control*

SA Safety Management Guide

Flame Resistant Clothing (FRC)

American National Standards Institute (ANSI)/International Safety Equipment Association (ISEA)

ANSI/ISEA Z87.1, *American National Standard for Occupational and Educational Personal Eye and Face Protection Devices*

ANSI/ISEA Z89.1, *American National Standard for Industrial Head Protection*

American National Standards Institute (ANSI)/American Industrial Hygiene Association (AIHA):

ANSI/AIHA Z88.2, *Practices for Respiratory Protection*

U.S. Code of Federal Regulations (CFR):

29 CFR 1910, Subpart I, *Personal Protective Equipment*

29 CFR 1926, Subpart E, *Personal Protective and Life Saving Equipment*

3.3 General Requirements

3.3.1 When a hazardous situation is recognized, steps shall be taken to eliminate the hazard by use of engineering or administrative controls. If engineering and administrative controls do not adequately eliminate the hazard, PPE shall be used to protect personnel from the hazard.

3.3.2 At a minimum, hard hats, safety glasses and safety shoes shall be worn in SA restricted areas and project work sites. Additional PPE shall be selected and used based upon the results of a documented PPE needs analysis, which shall consider the exposure hazard(s), materials handled and activities performed by personnel. Contractor's documented PPE needs analysis shall be made available to the SA proponent organization (SAPO) upon request.

3.3.3 Supervisors shall ensure their personnel are trained in inspection, use, maintenance and storage of PPE according to the manufacturer's instructions and this chapter.

3.3.4 PPE shall meet applicable ANSI requirements or equivalent as specified in writing by the SA Loss Prevention Department.

3.3.5 Proper PPE (e.g., correct for type of exposure, sized to fit the worker, meets applicable standards, no defects) shall be provided to personnel when/where required.

3.3.6 See Chapter IV-2, *Marine Operations*, of this manual, for additional PPE requirements for work on, over or near water.

3.3.7 PPE shall be visually inspected by the user before each use. Defective or damaged PPE shall not be used and shall be immediately replaced.

3.3.8 PPE that has exceeded its useable service life shall be immediately replaced.

3.3.9 Clothing shall be free of holes, excessive wear and other defects. Only proper work clothing (e.g., coveralls, long pants and sleeved shirt) shall be worn by personnel performing construction, maintenance and operations work (e.g., traditional loose flowing "Eastern" style clothing shall not be worn, since it presents tripping and entanglement hazards).

3.4 Head Protection

3.4.1 Personnel shall wear approved hard hats in designated areas, including (1) construction sites, (2) operating plant areas, (3) where there are overhead objects or activities that can result in falling or flying objects or (4) when performing activities that have potential electrical shock or burn hazards to the head.

3.4.2 Hard hats shall meet ANSI Z89.1, Type "1'', Class "E" (electrical) requirements and shall consist of a shell, suspension cradle and, optionally, a chin strap.

3.4.3 Hard hat suspension cradles shall be properly adjusted. There shall be a minimum 3.8 cm (1.5 inches) clearance between the top of the cradle and the inside of the hard hat shell.

3.4.4 Hard hats shall bear identification on the inside of the shell stating the name of the manufacturer, ANSI Z89.1 compliance, date of manufacture and class of the hard hat.

3.4.5 When earmuffs, welder's shields and/or face shields are required they shall be compatible with the hard hat used.

3.4.6 Hard hats shall not be painted, have holes drilled in them or have large stickers applied to them.

3.4.7 Hard hats shall be destroyed if they have been damaged (e.g., have a hole, gouge, crack or defective suspension cradle), painted or experienced a sharp impact.

3.4.8 Metallic hard hats shall not be used.

3.4.9 Hard hats shall be worn in accordance with the manufacturer's recommendations.

3.4.10 Hard hats shall be replaced not more than 5 years from the date of manufacture stamped/printed/embossed on the inside of the shell or as otherwise recommended by the manufacturer (e.g., every 3 years). Suspension cradles shall be replaced after no more than 12 months of use.

3.5 Eye and Face Protection

3.5.1 Eye and face protection devices shall meet ANSI Z87.1 requirements.

3.5.2 Approved safety eyewear with side protection shall be worn in designated areas and as needed to protect the worker's eyes from flying particles, chemicals, etc.

3.5.3 Prescription safety glasses (spectacles) with side shields and shatter-proof lenses, or over glasses that completely cover the worker's regular prescription glasses, shall be provided to personnel requiring them.

3.5.4 Additional approved hazard-specific eye/face protection (e.g., safety goggles, face shield) shall be worn as needed to protect the worker's face and neck from flying particles, sprays of hazardous liquids, splashes of molten metal, etc.

3.5.5 Selection, fit and use of eye and face protection devices shall be based on the hazard and the visual needs/limitations of the intended user. See Figure 3.1 for examples of typical eye and face protection devices.

3.5.6 Safety glasses or goggles shall always be worn under a face shield and welding helmet.

3.5.7 Personnel working with or near hazardous liquids shall wear splash-proof goggles with rubber seals that fit flush against the face, including with a face shield if required. See Chapter I-10, *Hazardous Materials*.

3.5.8 Electrical workers shall wear an arc rated face shield or arc flash hood as required by GI 2.721.

3.5.9 Personnel performing welding operations shall wear an approved welder's helmet with the proper lens shade. Torch welders, cutters and brazers shall wear special shaded goggles. See Chapter II-10, *Cutting, Welding and Brazing*.

Safety glasses with side shields	Face shield
Safety goggles	**Welding helmet**

Figure 3.1 Typical Eye and Face Protection Devices

3.6 Hand Protection

3.6.1 Gloves shall be selected and worn based on the materials or equipment being handled. Gloves shall be resistant to hazards specific to the job; such as, but not limited to: hot surfaces, acid/caustic/corrosive chemicals, abrasion, sharp edges, high voltage/electrical and cold surfaces/cryogenics. See Figure 3.2 for examples of typical types of gloves.

3.6.2 Gloves shall be the proper size to fit the wearer's hand to ensure proper grip. One size does not fit all.

3.6.3 High-voltage rubber gloves with leather protectors shall be worn by electrical workers as required. See GI 2.721 and Chapter III-3, *Electrical Equipment*, for more information including inspection and maintenance requirements.

3.6.4 Gloves shall not be worn near moving machinery/rotating equipment or when they could present a safety hazard (e.g., where gloves could get caught between moving machinery parts).

Heat resistant	Abrasion resistant (leather)
Chemical resistant	**High voltage**

Figure 3.2 Typical Glove Types

3.7 Foot Protection

3.7.1 Approved safety footwear shall be worn in field operations, process areas and other designated areas. Foot protection shall comply with GI 8.005 requirements.

3.7.2 Safety footwear shall be selected and used based on the need for oil/abrasion/chemical/impact resistance, heat protection, electrical insulation and comfort.

3.7.3 Safety footwear shall fit properly and shall be worn to cover the entire foot, including the heel.

3.7.4 Safety footwear shall have leather uppers and/or leather composition with steel or nonmetallic composite toecaps. Soles and heels shall be of the nonslip type. However, when working in water or wet areas requiring waterproof footwear, rubber safety boots are allowed.

3.7.5 Personnel working with or near jackhammers, soil compactors and concrete breakers shall wear proper safety shoes, preferably with metatarsal guards.

3.7.6 Nonconductive safety shoes shall be worn by anyone working on electrical equipment. Safety shoes shall not be used when working on electrical equipment if the shoe becomes wet, the rubber sole is worn through or metal particles become embedded in the shoe's sole or heel.

3.8 Hearing Protection

3.8.1 Ample supplies of approved hearing protection (e.g., earplugs) shall be provided at the job site and shall be worn in high noise areas (i.e., 85 decibels [dBA] or higher).

3.8.2 Plain cotton earplugs shall not be used for hearing protection.

3.8.3 Personnel shall not be exposed to impulse or impact noise levels that exceed the requirements of SAES-A-105. The need for additional hearing protection devices shall be evaluated prior to performing work.

3.8.4 Disposable earplugs shall be discarded at the end of each shift.

3.9 Body Protection

3.9.1 Body protection shall be provided and worn by personnel as needed to protect against hazards such as flash fire, electrical arc flash (see GI 2.721), abrasive blasting, welding, handling asbestos or acidic/corrosive liquids, etc. This protection may include flame resistant clothing (FRC), Tyvek, leather or nonpermeable materials.

3.9.2 FRC shall be provided to and worn by SA and contractor personnel in the specific locations and operating areas where the SAPO has assessed the flash fire hazard and determined that FRC is required.

3.9.3 FRC for protection against flash fire shall be per the SA *Safety Management Guide for Flame Resistant Clothing (FRC)*. The FRC specified in this safety management guide does not provide sufficient protection against electrical arc flash hazards. The proper arc flash FRC/PPE shall be provided to and worn by electrical workers per GI 2.721.

3.10 Fall Protection

PPE used to protect against the risk of falling and related requirements are contained in Chapter II-5, *Fall Protection*, of this manual.

3.11 Respiratory Protection Equipment (RPE)

3.11.1 General RPE Requirements

A. RPE shall be provided and used by personnel exposed to air contaminants exceeding the permissible exposure limit (PEL). See Figure 3.3 for various types of RPE.

B. RPE shall meet ANSI Z88.2 requirements.

C. Self-contained breathing apparatus (SCBA) shall be positive-pressure type. Negative-pressure SCBA shall not be used.

D. Breathing air compressors shall be in accordance with Chapter III-2, *Mechanical and Heavy Equipment*.

E. Breathing air quality shall meet Compressed Gas Association (CGA) Grade 'D' requirements (see GI 1780.001) and shall be supplied via an SCBA, air-line cascade system or air-fed hoods with proper particulate/moisture filters and air temperature monitoring.

F. An atmosphere-supplying respirator shall be used when an oxygen-deficient atmosphere could exist or in the presence of toxic hazards where cartridge/filter RPE is inadequate (e.g., H_2S).

G. Personnel shall perform a face seal check to ensure a proper seal prior to every use.

H. RPE shall be inspected by the user before and after each use.

I. RPE maintained for emergency situations shall be inspected at least weekly.

J. RPE shall be cleaned and sanitized after use.

K. RPE shall be stored in a manner to protect from dust, sunlight, heat or damaging chemicals.

3.11.2 Supervisor RPE Responsibilities

Supervisors shall:

A. Identify and evaluate respiratory hazards in the work area.

B. Select the appropriate RPE for the specific hazard(s).

C. Verify RPE meets ANSI Z88.2.

D. Verify that filters, cartridges and/or RPE are correct and rated for use in the intended hazardous atmosphere.

E. Ensure personnel are properly trained on the hazards requiring RPE and the proper use, maintenance and storage of RPE.

F. Fit-test users while they are wearing the RPE to confirm there is a proper face mask seal to prevent leakage.

G. Ensure that other PPE (e.g., safety glasses) does not interfere with the proper fit of the RPE.

H. Ensure/verify the exposure does not exceed the manufacturer's limits for the selected RPE, filter or breathing air (e.g., could decrease RPE effectiveness by clogging the filter).

I. Conduct periodic RPE inspections and document the findings. Copies shall be submitted to the SAPO upon request.

3.11.3 RPE Training

Employees shall be trained on how to use RPE safely and efficiently. This training shall include:

A. Specific hazards the RPE is designed to protect against.

B. How to wear the RPE, the proper position on the face, where to place the head straps and how to adjust strap tension.

C. The role of exhalation valves and filters.

D. How to properly clean and store RPE.

E. How to identify when RPE is no longer safe to use (e.g., mask is defective, filter/cartridge has exceeded its allowable exposure limits).

F. The warning signs indicating RPE failure.

3.11.4 Proper Usage of RPE

Personnel shall:

A. Not use air-purifying (cartridge type) RPE when potential exposure levels are above the RPE-rated capacity or the immediately dangerous to life or health (IDLH) concentration of the material.

B. Not use air-purifying (cartridge type) RPE in oxygen-deficient atmospheres (i.e., less than 20% oxygen) or for gases and vapors with poor warning properties (e.g., no odor or deadens the sense of smell).

C. Not use incorrect cartridges or filters for the type and concentration of air contaminant.

D. Not use defective equipment.

E. Not use equipment without receiving adequate training.

F. Not wear improperly fitting or modified equipment.

G. Not mix and match RPE parts from different manufacturers.

H. Not use dust masks for protection against hazardous vapors or gases that require respiratory protection.

3.11.5 Air-Line RPE

A. Full-face, positive-pressure type air-line RPE shall be used. Half-face or negative-pressure type air-line RPE shall not be used.

B. Full-face air line RPE shall not be used when air contaminant concentrations are over 1,000 times the PEL. SCBA shall be used when air contaminant concentrations are or could be over 1,000 times the PEL.

C. Five-minute escape packs shall be attached to air-line RPE when exposure levels exceed the IDLH level.

D. Only CGA Grade 'D' or greater breathing air shall be supplied to air-line RPE.

E. Breathing air quality shall be checked periodically to ensure air quality is maintained. See Chapter III-2, *Mechanical and Heavy Equipment*. Test results shall be logged/maintained.

F. Air delivered to air-line RPE shall be no hotter than 37.8 °C (100 °F). Use of air-cooling devices (e.g., vortex tubes) may be necessary.

G. Air-line RPE shall not be used when the distance from the source of breathing air is greater than 91 m (300 ft).

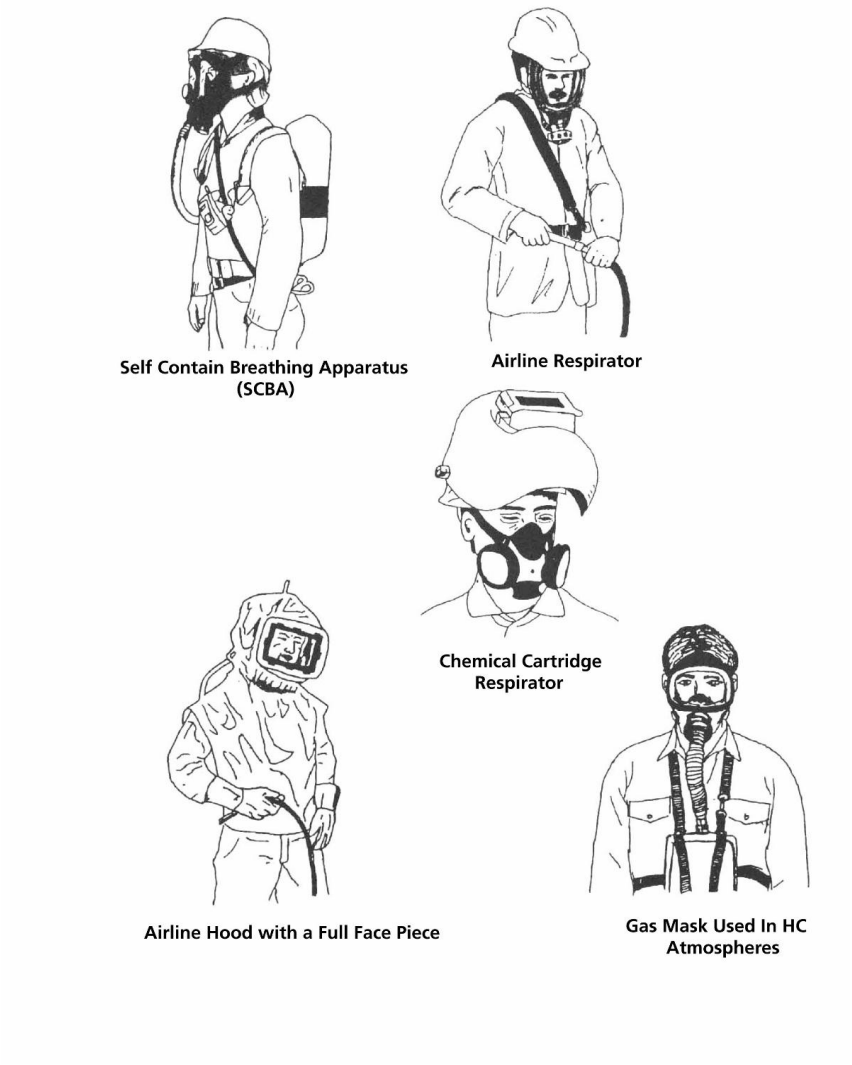

Self Contain Breathing Apparatus (SCBA)
Airline Respirator
Chemical Cartridge Respirator
Airline Hood with a Full Face Piece
Gas Mask Used In HC Atmospheres

Figure 3.3 Types of RPE

4. Work Permit System

4.1 Purpose

This chapter describes minimum requirements of the Saudi Aramco (SA) Work Permit System at maintenance and/or construction work sites that apply to SA employees and contractors.

4.2 References

SA General Instructions (GIs):

GI 2.100, *Work Permit System*

GI 2.709, *Gas Testing Procedure*

GI 887.000, *Coordination of Saudi Aramco Projects with Non-Saudi Aramco Agencies*

SA Safety Handbook, *Minimum Safety Rules*

4.3 General Requirements

4.3.1 Permits shall be used to control hazardous work activities at all SA facilities and locations. For SA operated facilities and for projects after hydrocarbons have been introduced, the SA work permit system shall be implemented per GI 2.100.

4.3.2 For grassroots projects during the construction phase and before hydrocarbons are introduced, contractors shall implement an equivalent work permit system in lieu of GI 2.100 to ensure safe execution of construction activities. The contractor's work permit system shall be subject to approval by the SA proponent organization (SAPO).

4.4 Certification

4.4.1 Work permit issuers and receivers shall have a valid SA issuer or receiver certificate, respectively. They shall attend and pass the work permit issuer or receiver course conducted by SA Training & Development.

4.4.2 The issuer/receiver's superintendent or, in the case of a contractor, the SAPO superintendent responsible for the work location, shall sign the issuer/receiver certificate. The Projects Review & Coordination Division, SA Affairs Services Department, shall certify non-Saudi Aramco contractor permit receivers.

4.4.3 Issuers/receivers with signed certificates from one organization shall not issue/receive permits at a different organization/facility, unless the responsible SAPO superintendent signs a reissued certificate that reflects the current organization.

4.5 Permit Types

4.5.1 There are four types of SA work permits. As per GI 2.100, they are:

Release of Hazardous Liquids or Gases, Form 924-1 (yellow)

The purpose of the Release of Hazardous Liquids or Gases Permit is to ensure that proper planning and precautions are taken during work activities where the release of hazardous liquids or gases may occur.

This permit does not authorize releases; rather it is to ensure that the appropriate precautions are in place.

Hot Work, Form 924-2 (red)

The purpose of the Hot Work Permit is to control work activities that may produce sufficient energy to ignite flammable atmospheres or combustible materials.

This permit shall be used for:

- Open flame, welding or torch cutting within a restricted area.
- Open flame, welding or torch cutting that occurs within 30 m (100 ft) of a pipeline or facility containing hydrocarbons.
- Work on live electrical equipment or use of electrical devices not classified as intrinsically safe (e.g., computers, boroscopes, mobile phones) within a restricted area.
- Other jobs/activities that could present a fire hazard (e.g., internal combustion engines, grit-blasting operations or electrical hand tools) within a restricted area.

Cold Work, Form 924-3 (blue)

The purpose of the Cold Work Permit is to control work activities that may not produce sufficient energy to ignite flammable atmospheres or combustible material but could contribute to injury.

This permit shall be used for, but not be limited to, the following work in restricted areas:

- Structural demolition or collapse of nonoperational buildings.
- Removal or disturbance of asbestos-containing material.
- Work activities involving cryogenic materials.
- Scaffold erection or demolition.
- Painting.
- Excavating by hand.
- Concrete pouring and formwork.

- Use of hand tools that have no electrical power.

Confined Space Entry, Form 924-4 (green)

The purpose of the Confined Space Entry Permit is to ensure:

- Proper preparation of confined spaces prior to entry.
- Safe entry by personnel, including provisions for rescue.
- Restoration of confined spaces.

Work activities inside a confined space may require a Hot or Cold Work Permit to be issued in combination with the Confined Space Entry Permit. Refer to Chapter I-6, *Confined Spaces,* of this manual for further requirements.

4.6 Issuance and Approval of Permits

4.6.1 Issuers and receivers shall have in their possession a valid SA work permit certificate.

4.6.2 SA and contractor-certified permit receivers shall request the proper permit(s) from a SAPO-certified permit issuer (e.g., supervising operator, operations supervisor) prior to executing any job. Permits shall be craft- and location-specific.

4.6.3 The issuer shall approve and issue a permit only after conducting a joint site inspection with the receiver to identify potential hazards, perform necessary gas tests, and write on the work permit the specific precautions necessary so the work can be performed safely. General statements, such as "work safely" or "wear PPE," are inadequate and shall not be written on the permit.

4.6.4 The issuer's and receiver's signatures, plus any other required approvals/signatures shall be on the completed permit. Issuers shall obtain countersignatures from applicable units/departments as needed.

4.6.5 Additional approvals/signatures shall be required for renewed/extended permits (see GI 2.100 and Section 4.7 of this chapter).

4.6.6 Permits shall be immediately voided, the work stopped and new permits issued if a change occurs in the work activities or site conditions that could potentially affect the safety of personnel at the site.

4.7 Issued Permits

4.7.1 Permits are normally issued for a single operating shift.

4.7.2 Permit extension is permissible for two consecutive operating shifts, regardless of the shift duration, but not more than 24 hours.

4.7.3 A work permit may be issued for up to 30 days for extended construction or maintenance work where the job requirements remain essentially unchanged, only under the following conditions:

A. It is highly unlikely that conditions at the job site will change or develop that would create a hazard to personnel, damage to equipment, result in an operations upset or harm the environment.

B. Precautions are taken, prior to performing the work, to ensure safe conditions throughout the work activities.

C. Both the operations division head and the maintenance/construction division head agree to job conditions and control measures to be used and shall sign the permit (see GI 2.100 for additional details).

4.7.4 Receivers are to remain on the job site at all times. However, if a receiver must leave the work area, he shall give the permit to another SA-certified permit receiver, who is a responsible senior crew member and is agreed to in advance by the issuer, who shall manage the work activity until the receiver returns. The receiver-alternate's name and badge number shall be written on the approved permit by the issuer.

4.7.5 Receivers shall keep permit copies, either in their possession or posted in plain view at the job location, at all times.

4.8 Closing Out and Filing the Permit

4.8.1 The receiver shall take the permit to the issuer for closeout signatures on both copies of the permit when the job is completed or when the permit has expired.

4.8.2 The only exception to Section 4.8.1 is at remote work sites when a permit may be closed over the telephone, if this arrangement is agreed to by the issuer when the permit is issued.

4.8.3 The original permit shall be maintained on file by the issuing department for a minimum of 3 months.

4.9 Permit Rules

4.9.1 The issuer and receiver shall conduct a joint site inspection before signing the permit. Work shall not begin before the permit has been properly signed.

4.9.2 The correct permit(s) shall be issued for the job: Hot, Cold, Confined Space Entry and/or Release of Hazardous Liquids or Gases. More than one permit may be required for some jobs (e.g., confined space entry).

4.9.3 The issuer shall review the permit and requirements for the type of work, verify required gas tests, and list applicable isolation and other precautions.

4.9.4 Atmospheric gas testing shall be conducted with SA-approved portable gas monitoring equipment for Confined Space Entry Permits, Release of Hazardous Liquids or Gases Permits, and/or Hot Work Permits where the presence of flammable vapors or gases is suspected. Tests for hydrogen sulfide (H_2S), oxygen concentration, flammable gases and/or any applicable toxic substances shall be performed before issuing these permits. Gas tests shall be performed for Cold Work Permits where applicable. See GI 2.100 and GI 2.709.

4.9.5 Hot work is not permitted if the atmosphere is above 0% of the lower explosive limit (LEL).

4.9.6 A breathing apparatus (e.g., self contained breathing apparatus) shall be used if any of the following atmospheric conditions exist:

- Oxygen (O_2) concentrations are less than 20.0%.
- Flammable mixtures are at or above 5% and less than 50% of the LEL.
- Hydrogen sulfide (H_2S) concentration is between 10 and 100 parts per million (ppm).

4.9.7 Job descriptions and equipment to be used shall be clearly stated on the permit(s). Permits shall be issued for specific tasks at specific locations. One permit shall not cover more than one location.

4.9.8 All check boxes shall be correctly filled in or marked N/A. Gas test readings also shall be recorded.

4.9.9 Proper locks and hold tags shall be used where applicable (e.g., multiple clips with locks or chains with locks). See Chapter I-5, *Isolation, Lockout and Use of Hold Tags*, for further requirements.

4.9.10 Permits shall be issued for the specific period of time required to complete the job.

4.9.11 Prior to the start of work, the work permit receiver shall communicate the hazards and precautions for the job, as well as other requirements on the permit, to all workers working under the permit.

4.9.12 Periodic reviews of the job site, including gas testing, shall be conducted as required.

4.9.13 Oncoming shift issuers and receivers shall inspect the job site, write the extended time and sign the permits when extending permit periods to another shift (per Section 4.7).

4.9.14 Special requirements and precautions, such as: fire watches, self-contained breathing apparatus (SCBA), lifelines and/or barricades shall be written on the permit.

4.9.15 In the event of an emergency, all active permits shall be immediately cancelled and work activities stopped.

4.9.16 Work areas shall be cleared of nonessential personnel to avoid exposing them to unnecessary hazards.

4.9.17 The issuer or receiver shall stop work and cancel the permit if there are changes in job site activities or conditions that adversely affect personnel or job safety. If a permit is cancelled, a new permit shall be issued after the work site has been made safe.

4.9.18 Permits shall be closed out (per Section 4.8) after the work is completed or the permit expires. The issuer and receiver shall inspect the job site and sign the permit to close it.

5. Isolation, Lockout and Use of Hold Tags

5.1 Purpose

This chapter describes minimum requirements for safely isolating energy sources and managing associated hazards during maintenance, inspection and construction activities, including facility modifications. This is applies to electrical sources of energy as well as other sources of potentially stored energy.

5.2 References

Saudi Aramco (SA) General Instructions (GIs):

GI 2.100, *Work Permit System*

GI 6.012, *Isolation, Lockout and Use of Hold Tags*

SA Safety Handbook, *Minimum Safety Rules*

5.3 General Requirements

5.3.1 Isolation of energy sources shall be per GI 6.012.

5.3.2 During job planning, an isolation plan shall be developed that shall identify all locations to be isolated, types of isolating devices to be used and site/job-specific procedures for isolating the equipment.

5.3.3 The isolation plan shall include a blind list if blinds are to be used. The blind list shall, at a minimum, include the following blind information: blind number, blind rating, date of installation, location, installer name, date of removal and remover name.

5.3.4 The isolation plan shall be reviewed and verified by relevant SA facility management (e.g., the operations shift superintendent for the unit where the isolation will occur) and contractor site management prior to the isolation work being performed. In some cases, additional SA operations shift superintendent(s) shall be required to also concur with the plan (e.g., where the isolation affects adjacent process units or other facilities). The SA facility management shall specifically concur with the blind list where plot/battery limit piping is involved.

5.3.5 All necessary isolation and blinding equipment/devices (locks, tags, properly rated blinds, etc.) shall be made ready and inspected before commencing work.

5.3.6 All forms of isolation (electrical, mechanical or otherwise) shall use the Lock/Hold Tag (SA Form 525) at every isolation point. See Figures 5.1 and 5.2. The following information shall be provided on all tags:

- Plant number/location.

- Equipment name.
- Date and time of lockout.
- Name, badge number, organization, contact phone and signature of the individual who installed the isolation device.
- The reason for the isolation.

5.3.7 Contractors shall establish an isolation, lockout and use of hold tag program for grassroots projects that is compatible with GI 6.012 and this chapter. For existing facilities, contractors are required to implement the SA proponent organization's isolation procedure.

Figure 5.1 SA Form 525, Front

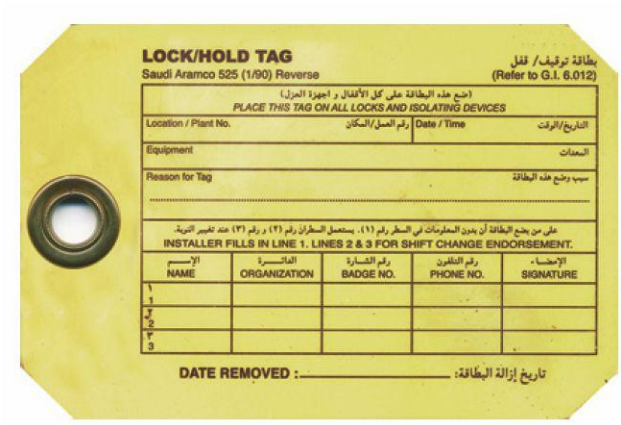


Figure 5.2 SA Form 525, Back

5.4 Electrical Lockout and Tagout (Lock, Tag, Clear, Try)

5.4.1 Isolation shall be considered complete only when no associated control device is capable of energizing the equipment.

5.4.2 In situations where it is not possible to lock out an isolating device, isolation may be accomplished by removal of fuses, disconnection of electrical cables, or physical removal of a component of the system

supplying energy to the equipment. The point of physical interruption shall be identified with a fully completed hold tag.

5.4.3 Each lock on a piece of equipment or on a multiple lockout clip shall be identified with a subsequent hold tag. See Figure 5.3.

Figure 5.3 Multiple Lockout Clip

5.4.4 Each organization issuing locks shall have a system of uniquely identified locks. Acceptable methods include color coding, stamping or engraving locks appropriately.

5.4.5 Each lock shall be keyed separately, with no duplicate key, to ensure removal only by the authorized user.

5.4.6 Operations representatives shall be the first to install their lock(s) and shall be the last to remove them.

5.4.7 Maintenance personnel shall install their lock(s) at each corresponding isolation point. Every individual worker shall have in place his personal lock(s) at all lockout locations.

5.4.8 Work shall not be allowed to commence nor shall any maintenance material/device be placed on the isolated equipment until a verification test has been performed to ensure isolation has been correctly carried out and that no residual energy exists within the equipment. "Clear" the area of all potential hazards associated with an accidental start-up (e.g., tools, materials, personnel at a hazardous location). Then a verification test (or "Try") shall be witnessed by all affected parties and shall be conducted for each potential energy source for the equipment being isolated.

5.4.9 No padlock/lockout device shall be cut or forcefully removed without the permission of the lock owner's superintendent or operating shift superintendent and such actions shall be in accordance with GI 6.012.

5.4.10 A "group lockout" procedure shall be implemented during maintenance and construction activities involving large numbers of personnel, such as: turnarounds and inspections (T&Is), facility expansions or compressor

repairs. Personnel shall be afforded individual protection and the following steps shall apply to group lockout:

A. An operations representative shall lock and tag each isolation point with single-keyed locks per the requirements of this document or written departmental isolation procedure/instructions.

B. The maintenance/construction supervisor shall also lock and tag each isolation point.

C. The maintenance/construction supervisor's key(s) to these locks shall be placed in a group lockout box.

D. Multiple lock clips (hasps) shall then be attached on the closed group lockout box, as required.

E. The operations representative shall install his lock and tag on the group lockout box first. He shall maintain possession of his key(s) until the job is complete.

F. Each member of the maintenance/construction crew shall then place his lock and tag on the group lockout box (use a multiple lock clip (hasp) if necessary) and maintain possession of his key(s) until the job is complete.

G. When a craft shift change occurs and work has not been completed, the oncoming shift may either:

- Replace the previous shift's locks and tags with their own locks and tags, in which case the off-going shift shall remove their locks and tags.

- Transfer keys between shifts. This transfer requires the craft supervisors to conduct a detailed review of installed locks and tags. Hold tags belonging to the original shift crew shall be signed by the oncoming shift personnel, or entirely new tags shall be completed by the oncoming shift and installed to replace the original shift's hold tags.

5.5 Piping and Equipment Isolation and Blinding

5.5.1 Piping or equipment shall be isolated and/or blinded and the contents drained, vented or purged before any work is performed (inspections, repairs, maintenance, modifications, etc.).

5.5.2 Operations or proponent organizations shall ensure that specific isolation, lock and hold tag procedures are in place to protect personnel when such activities are performed.

5.5.3 The levels of isolation are listed in Table 5.1 in the increasing order of protection (first being the lowest and last being the highest) and shall be applied accordingly depending on the nature of work.

5.5.4 If isolating by double block and bleed (DB&B), which involves locking closed two isolation valves in series, and locking open a drain/vent valve between the two isolation valves (see Figure 5.4), a hose or hard piping shall be attached to the drain valve to ensure that any liquid that might pass is carried away from the work site and all locks shall be tagged.

Table 5.1 Levels of Isolation

Method of Isolation	Degree of Protection	Examples of Use
Single block valve	Minimum	Changing a gauge or sock filter, swinging a blind (minimum routine maintenance)
Double block and bleed (DB&B)	Medium	Removing a control valve
Disconnection (removal/dropping of a spool piece)	Maximum	Long-term construction/maintenance work
Blinding	Maximum	Confined space entry/hot work

Notes:

- All means of isolation shall be locked and tagged accordingly.
- When using a single block valve, fluid shall be removed and valve tested for leakage before commencing work.

5.5.5 In order for DB&B to be utilized, the subsequent bleed (vent/drain) valve shall be adequately sized in order to handle the upstream pressure in the event the first isolation valve fails/passes. Vents and drains shall be verified to be clear of obstruction.

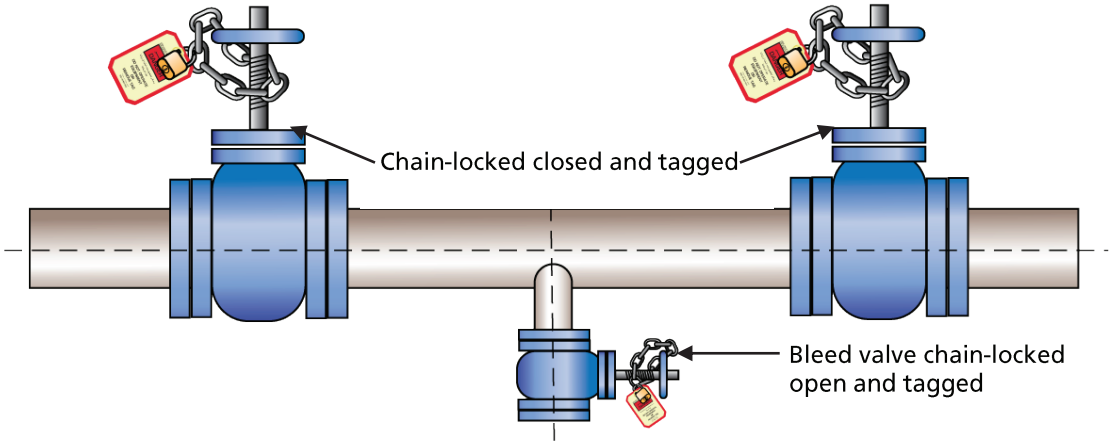


Figure 5.4 Double Block and Bleed Assembly with Chain Locks and Tags

5.5.6 Single block valve and DB&B isolations shall not be used when equipment or a piping containing hazardous materials is to be opened for confined

space entry or hot work activities. This type of work activity requires isolation by blinding.

5.5.7 Blinding involves inserting a slip blind or blind flange at a flanged joint or a swinging (rolling) a spectacle blind if provided by design. See Figures 5.5, 5.6 and 5.7.

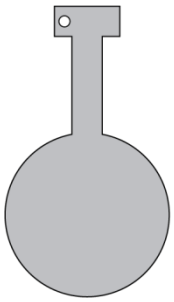


Figure 5.5 Slip Blind

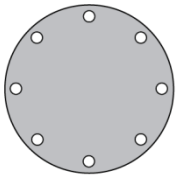


Figure 5.6 Blind Flange

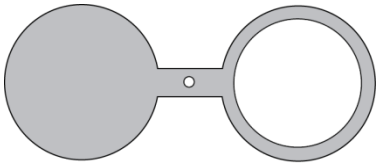


Figure 5.7 Spectacle Blind

5.5.8 The rating, size and location of all blinds shall be verified prior to installation and shall be reflected on the blind list. Each blind shall be stamped with the corresponding pressure rating and installed with matching gaskets.

5.5.9 Blind gaskets shall be inspected for damage prior to installing/swinging blinds.

5.5.10 Written procedures shall be developed and implemented for major equipment with multiple connections and several low points where hazardous materials might remain trapped.

5.5.11 These written procedures shall include, but not be limited to:

- Drawings (P&IDs, isometric drawings, etc.) indicating all isolation points, drains and vents.
- The blind list, to track installation (and later removal) of all blinds.
- The steps or sequence for depressurization, draining and purging of equipment and associated piping before blinds are inserted.
- Site preparation steps (e.g., covering sewers).
- Proper sequence for installing blinds.
- Safe venting and disposal of any drained material.

5.5.12 Associated equipment and piping shall be isolated by closing block valves, depressurization, draining and purging (for flammable/toxic service piping). Valves shall be chain-lock closed and tagged before opening the flange and shall remain so while any blinds are in place. Valve locks and tags can be removed when the subsequent blinds are removed and the flanged connection restored to its original condition.

5.5.13 Piping sections with valves on each end, drains at low points and vents at high points shall be isolated, depressurized and drained prior to work. Piping that has no drains or vents shall not be opened.

5.5.14 A Release Permit shall be issued before commencing any blinding activity. Blind swinging/insertion shall be covered by a Hot or Cold Work Permit as well, depending on the circumstances (using impact wrench with generator vs. using hand tools).

5.5.15 Blinding shall be performed by loosening the bolts and cracking the flanged connection at the "5 o'clock position" (down and away from the person performing the work) to allow any potential gases or liquids to be released away from personnel.

5.5.16 When equipment (e.g., pump, meter or filter) is removed from service for long-term maintenance or construction activities, subsequent blinds shall be required for associated piping.

5.5.17 Blinds shall be inserted only at the isolated side (i.e., downstream) of each isolation valve that has been locked closed and tagged.

5.5.18 Blinds shall be accessible and scaffolding shall be provided where necessary.

5.5.19 The first blind inserted shall be the last to be removed.

5.5.20 All bolt holes of the blind and corresponding flange connection shall be used when installing blinds.

5.5.21 All slip blinds shall have tails as shown in Figure 5.5.

5.5.22 Safety precautions shall be taken (e.g., use of self-contained breathing apparatus) for removing blinds since hazardous materials might have accumulated between the blind and the corresponding isolated valve if the valve was passing.

5.6 Power Operations Department Clearances

5.6.1 The SA Power Operations Department (POD) shall issue clearances as required before work is performed on or near high-voltage electrical equipment (e.g., that has been de-energized and isolated from the power system in an approved manner). See Chapter III-3, *Electrical Equipment*, of this manual.

5.6.2 Clearances shall be issued by POD dispatchers in addition to any work permits that are required. See Chapter I-4, *Work Permit System*.

5.6.3 The proponent organization and contractors shall contact POD directly to coordinate with the POD electric system operators for assistance.

6. Confined Spaces

6.1 Purpose

This chapter describes minimum site safety requirements for personnel performing work inside confined spaces.

6.2 References

Saudi Aramco (SA) General Instructions (GIs):

GI 2.100, *Work Permit System*

GI 2.709, *Gas Testing Procedure*

GI 6.008, *Restriction of Portable Electrical/Electronic Devices*

GI 6.012, *Isolation, Lockout and Use of Hold Tags*

GI 430.001, *Waste Management*

GI 1780.001, *Atmosphere Supplying Respirators*

SA Engineering Standards (SAESs)

SAES-B-068, *Electrical Area Classification*

SAES-P-123, *Lighting*

SA Safety Handbook, *Minimum Safety Rules*

6.3 General Requirements

6.3.1 Confined space entry within a SA operated facility or at a project site after hydrocarbons have been introduced shall be in accordance with this chapter and local instructions.

6.3.2 A confined space entry permit shall be issued in accordance with GI 2.100 prior to entry into a confined space located within a SA operated facility or at a project site after hydrocarbons have been introduced. Other permits may be required (e.g., hot work permit or cold work permit), depending on the type of work to be conducted within the confined space.

6.3.3 For confined space entry performed only by personnel from a SA proponent department/organization (e.g., plant operations), the confined space entry permit shall be issued to a SA-certified Work Permit Receiver from the proponent department/organization.

6.3.4 For grassroots construction projects, contractors shall implement equivalent confined space entry permit procedures to ensure safe execution of construction activities. The contractor's confined space entry permit procedures shall be subject to approval by the SA proponent organization (SAPO).

6.3.5 Every job that requires a confined space entry shall have a designated confined space entry supervisor (CSES). See Section 6.4.1 for CSES responsibilities.

6.3.6 A standby man shall be assigned by the CSES at each designated entry point and shall continuously monitor the confined space entry while personnel are inside the confined space. In certain situations (e.g., multiple entry/exit points) more than one confined space standby man is required. See Section 6.4.2 for standby man responsibilities.

6.3.7 Standby men shall be provided with adequate means of communication (e.g., two-way radio) to ensure continuous communication with entrants and with the proper personnel (e.g., CSES, rescue team) in event of an emergency.

6.3.8 At least one fire extinguisher (30 lb) shall be provided near each designated confined space entry point if the space is within process equipment (e.g., vessel, column, tank) or where combustible or flammable material may be present (including residue). Carbon dioxide (CO_2) type fire extinguishers shall not be used inside enclosed confined spaces.

6.3.9 A confined space entry checklist (such as the sample checklist at the end of this chapter) shall be used by the CSES, etc., to help ensure safety requirements are met.

6.3.10 Confined space standby men and entrants shall be physically fit for entry.

6.3.11 Each designated confined space entry point shall be evaluated to ensure entrants can safely enter and exit the confined space. Designated entry points shall not be blocked or obstructed with equipment while entrants are inside the space (e.g., air cooling/ventilation hoses blocking an entry point).

6.3.12 The completed work permit(s) (e.g., confined space entry, hot work), confined space warning signs and barricades shall be posted outside the confined space to notify personnel that a confined space entry is in progress and to prohibit entry by unauthorized personnel.

6.3.13 Confined space warning signs shall comply with SAES-B-067 and read in Arabic and English as follows:

Arabic text:	English text:
منطقة محصورة خطرة الدخول ممنوع لغير المصرح لهم	Danger Confined Space No Unauthorized Entry

6.3.14 When the potential exists for persons or objects to fall into a confined space, additional warning signs and/or barricades shall be provided.

6.3.15 Prior to entry, chemical and physical hazards shall be eliminated or controlled by one or more of the following methods: equipment isolation (e.g., lockout/tagout), draining, water washing, steam cleaning, purging, etc. See Sections 6.6, 6.8, and 6.9 for further information.

6.3.16 Mechanical ventilation (e.g., air movers) shall be used to ensure removal of all hazardous airborne contaminants in confined spaces where a hazardous atmosphere exists or could develop during the course of planned work. See Section 6.8 for further information regarding ventilation.

6.3.17 Atmospheric gas testing shall be in accordance with GI 2.709 and Section 6.7.

6.3.18 The proper personal protective equipment (PPE) shall be provided to personnel entering a confined space and to each standby man. PPE shall be continuously used during the confined space entry. See Chapter I-3, *Personal Protective Equipment (PPE)*, of this manual.

6.3.19 Only properly trained and authorized personnel shall enter a confined space. Verification of training shall be made available upon request by the SAPO.

6.3.20 Personnel entering/exiting a confined space shall sign a log in/out sheet. See the sample log sheet at the end of this chapter.

6.3.21 Ignition sources shall be eliminated or controlled within a confined space. If ignition sources are present (e.g., sparks or open flames), a hot work permit shall be issued and periodic gas tests performed.

6.3.22 Electrical equipment, including lighting, used in an electrically classified area (see SAES-B-068) shall be Underwriters' Laboratories (UL) listed, Factory Mutual (FM) approved or equivalent. Electrical equipment (including radios) shall be in accordance with the electrical classification of the confined space and as per the requirements of GI 6.008 and SAES-B-068.

6.3.23 Ground fault circuit interrupters (GFCIs) shall be utilized on all electrical-powered equipment used inside a confined space regardless of the electrical classification of the space.

6.3.24 Lighting shall be provided as needed to safely enter, exit and work inside a confined space. Lighting shall be on a separate electrical circuit from other electrical equipment and tools used in the confined space.

6.3.25 If the confined space is within process equipment (e.g., vessel, column, tank) or where combustible or flammable material may be present (including residue), portable lighting shall be rated for an electrical classification not less than Class I, Zone 2 and shall not be used in the

confined space without a hot work permit per GI 2.100, except explosion proof flashlights. See Chapter, I-11, *Hand Tools and Power Tools*, for further information on portable lighting.

6.3.26 When electrical power cords are used inside a confined space, protection shall be provided near sharp edges and through entry points to prevent damage to the power cords.

6.3.27 Compressed gas cylinders shall not be placed in a confined space.

6.3.28 Internal combustion engines shall not be positioned inside a confined space or at a location that could allow exhaust to enter the space. This type of equipment shall be positioned downwind from confined space entry/exit points and air mover intakes.

6.3.29 Personnel in an enclosed confined space where vertical rescue may be required (e.g., inside a vessel, column, tank) shall wear a full-body harness.

6.3.30 Fall protection (e.g., full-body harness/lanyard, scaffolding) shall be used if personnel could fall more than 1.8 m (6 ft) when working inside the confined space.

6.3.31 Entrants to a process-related confined space or where movement is inhibited or difficult (e.g., inside a vessel, column, tank) shall be given breaks as needed and allowed to rest outside in an open area. The CSES shall arrange these breaks accordingly. See Chapter I-13, *Heat Stress*.

6.3.32 Flammable/combustible materials shall not be stored inside a confined space.

6.3.33 Entry into a confined space where naturally occurring radioactive material (NORM) contamination is known or suspected shall be subject to the following controls:

- An enclosed confined space (e.g., vessel, column, tank) shall be mechanically ventilated for a minimum of four hours prior to entry.
- Personnel and equipment exiting the confined space shall be subject to a NORM contamination survey.
- Personnel or equipment found to be contaminated with NORM shall be segregated and decontaminated. See Chapter I-10, *Hazardous Materials*.

6.3.34 Where hydroblasting operations are occurring inside a confined space, low point drains shall remain open (car sealed) to eliminate water accumulation.

6.3.35 Rescue equipment and a rescue team shall be available in the event of an emergency requiring evacuation of the confined space.

6.3.36 In the event of a confined space rescue, the confined space atmosphere shall be considered immediately dangerous to life or health (IDLH) and positive-pressure self-contained breathing apparatus (SCBA) or air-line respirators with an emergency escape cylinder shall be used by all personnel entering the confined space.

6.3.37 If the confined space entry activity is suspended, the entry point(s) shall be barricaded and a "NO ENTRY" sign shall be posted.

6.3.38 When work is complete and the confined space is ready to be returned to normal service, the confined space shall be inspected to ensure all equipment and tools have been removed, etc.

6.4 Responsibilities

6.4.1 CSESs (e.g., Supervising Operator, Work Permit Issuer) shall:

A. Review the confined space entry plan that is unique to the specific confined space.

B. Communicate the confined space entry plan (e.g., specific confined space hazards, precautions, responsibilities, emergency procedures) to entrants and standby men.

C. Ensure proper work permits (confined space entry, hot work, etc.) are issued.

D. Verify all precautions of the confined space entry plan and applicable work permits are properly implemented.

E. Designate qualified standby men who are fluent in the language needed to communicate with the CSES or rescue team.

F. Verify entrants and standby men are properly trained.

G. Coordinate confined space operations when employees of more than one maintenance crew or contractor will be working simultaneously inside or adjacent to the confined space.

H. Provide sufficient manpower and equipment for safe confined space entry and work inside the space.

I. Verify the confined space is properly isolated per GI 6.012, purged and the atmosphere is safe to enter.

J. Ensure the atmosphere within the confined space is monitored as indicated on the confined space entry permit and/or the confined space entry plan.

K. Ensure confined space entry and gas test logs are properly completed.

L. Ensure the proper PPE is provided to personnel entering the confined space and to each standby man.

M. Ensure adequate means of communication (e.g., two-way radio), fire extinguisher (non-CO_2 type) and SCBA are available to each standby man.

N. Verify rescue equipment and a rescue team are available in the event of an emergency requiring evacuation of the confined space.

O. Ensure the confined space entrance is barricaded/blocked and a "NO ENTRY" sign posted if the confined space entry is suspended.

P. Terminate confined space entry and cancel work permit(s) as necessary (e.g., unsafe conditions develop).

6.4.2 Confined space standby men shall:

A. Review the confined space entry plan and applicable work permits to understand the confined space hazards, precautions, responsibilities and emergency procedures.

B. Understand the effects of exposure to potential hazardous substance(s) in the confined space.

C. Maintain a confined space entry log and maintain a continuous count of entrants.

D. Prevent unauthorized personnel from entering the confined space.

E. Monitor activities inside and outside the confined space to determine if it is safe for entrants to enter and/or remain inside the space.

F. Maintain two-way communication with entrants to monitor entrant status (e.g., behavioral effects of hazard exposure) and alert entrants of a need to evacuate the confined space.

G. Have communications equipment readily available on-site and immediately notify proper personnel (e.g., CSES, rescue team) in event of an emergency.

H. Remain at the confined space entry point until relieved by another designated standby man or until all entrants have exited the confined space.

I. Never attempt to enter the confined space, even in an emergency, until relieved.

J. Perform no other duties that could interfere with his primary responsibilities as a confined space standby man.

K. Order entrants to evacuate the confined space under any of the following conditions:

- An unsafe condition develops inside or outside the confined space.
- An entrant displays abnormal behavioral effects of hazard exposure.
- If he must leave the area and no relief confined space standby man is provided.

6.4.3 Entrants into a confined space shall:

A. Review the confined space entry permit and confined space entry plan and verify that all precautions have been properly implemented.

B. Understand the effects of exposure to potential hazardous substance(s) in the confined space.

C. Understand the proper use of PPE that is to be used inside the confined space.

D. Not enter a confined space until they are satisfied that all necessary precautions have been properly taken to ensure their safety and they clearly understand their work assignment within the space.

E. Communicate with the confined space standby man to enable the standby man to monitor the entrants' status (e.g., behavioral effects of hazard exposure).

F. Promptly alert the confined space standby man and other entrants, and/or exit from the confined space as quickly as possible, whenever:

- An order to evacuate is given by the confined space standby man or the CSES.
- The entrant recognizes any warning signs or symptoms of exposure to a hazardous condition or substance.
- An emergency alarm is activated.

6.5 Confined Space Entry Plans

6.5.1 A confined space entry plan shall be developed by the SAPO or by the contractor (e.g., for a grassroots construction project) prior to entry into a confined space.

6.5.2 The confined space entry plan shall include, but not be limited to, the following:

A. Scope of work.

B. Results of hazard evaluation (e.g., potential hazards in the confined space and the adjacent area).

C. Location and method for each isolation point of the confined space, including a drawing (e.g., P&ID) and blinding list to assist in verifying isolation of all energy sources.

D. Procedures for cleaning, flushing, purging and/or ventilating the confined space to eliminate or control atmospheric hazards.

E. Access and egress requirements.

F. Pedestrian, vehicle or other barriers as necessary.

G. Fall protection plans whenever an entrant could fall more than 1.8 m (6 ft).

H. Types and frequency of atmospheric gas testing.

I. Types of PPE required (e.g., flame-resistant clothing [FRC], hardhat, safety glasses/goggles, safety shoes, respiratory protective equipment, appropriate gloves, protective coveralls based on potential skin absorption of hazardous materials).

J. Work permit requirements for controlling hazards inside the confined space.

K. Types of equipment required for confined space entry (e.g., scaffolding, air movers, rescue equipment, communication equipment, fire extinguishers).

L. Emergency response/rescue procedures.

6.5.3 The confined space entry plan shall address potential hazards that could develop when employees of more than one maintenance crew or contractor are working simultaneously as authorized entrants in the confined space.

6.5.4 The confined space entry plan shall be made available for review by personnel involved in the confined space entry.

6.6 Isolation and Lockout/Tagout of Confined Spaces

6.6.1 Before personnel are permitted to enter a confined space, all equipment and sources of kinetic and potential stored energy shall be physically de-energized, immobilized, disabled, relieved, disconnected and/or restrained in accordance with GI 6.012. Potential sources of energy include, but are not limited to, electrical, mechanical, hydraulic, chemical and pneumatic systems.

6.6.2 Blinding or disconnecting of piping shall be the only acceptable method of isolation for confined space entry. Single closed valve or double block and bleed are not acceptable methods of isolation for confined space entry.

6.6.3 Precautions shall be taken to ensure that air contaminants from adjacent processing or chemical handling cannot enter the confined space.

6.7 Atmospheric Gas Testing

6.7.1 Atmospheric gas testing within confined spaces shall include, but not be limited to, testing for oxygen (O_2), flammable mixtures (Lower Explosive Limit [LEL]) and toxic gases (e.g., H_2S). Note: Current SA gas-testing equipment (i.e., Industrial Scientific LTX-310 and LTX-412) requires a minimum of 16.0% oxygen to properly detect the presence of flammable or combustible gases (i.e., LEL).

6.7.2 Atmospheric gas tests shall be performed and immediately recorded:

- Prior to entry.
- After breaks or other interruptions in the work.
- If there is any reason to believe that conditions inside the confined space have changed.
- At periodic intervals (e.g., every 2 hours) as necessary to determine whether acceptable atmospheric conditions are being maintained during the course of the confined space entry.

6.7.3 Atmospheric gas tests shall only be conducted by a SA-certified gas tester per GI 2.709, except for grassroots construction projects which shall be per Chapter I-4, *Work Permit System*.

6.7.4 Initial gas testing prior to entry shall be performed with all mechanical ventilation shut down at least 15 minutes prior to testing.

6.7.5 Initial entry shall be prohibited if gas testing indicates an oxygen deficiency or the presence of unacceptable levels of flammable (LEL) or toxic materials, etc., within the confined space. Only after purging with mechanical ventilation and/or cleanup has rendered the space free of hazardous concentrations (as verified by continuous gas testing inside the confined space) shall initial entry be allowed.

6.7.6 Additional gas testing (e.g., after breaks) shall be conducted with the ventilation system turned on to ensure that contaminants are being removed and that the ventilation system is not a source of contamination.

6.7.7 Continuous gas testing (e.g., by use of personal gas monitors) shall be used if the atmosphere inside the confined space is subject to change or if confined space entry activities involve combustion (e.g., welding or torch cutting).

6.7.8 Monitoring for carbon monoxide (CO) shall be conducted if activities inside the confined space involve combustion (e.g., welding, torch cutting).

6.7.9 Whenever a hazardous atmosphere is detected, the confined space shall be evacuated of all personnel until corrective actions have been taken and it has been verified by the CSES that the confined space is safe for re-entry.

6.7.10 Hot work shall not be permitted if the atmosphere is above 0% of the LEL.

6.7.11 The following conditions are required prior to entry into or work inside a confined space:

A. No atmosphere-supplying respirator is required if:

- Oxygen (O_2) concentration is between 20.0% and 23.5%.
- Flammable mixtures are less than 5% of the LEL.
- CO is at or below 35 parts per million (ppm).
- Hydrogen sulfide (H_2S) is at or below 10 ppm.
- Other potential toxic gas concentrations are at or below their threshold limit value (TLV).

B. An atmosphere-supplying respirator shall be continuously worn if:

- O_2 concentrations are less than 20.0%.
- Flammable mixtures are at or above 5% and less than 50% of the LEL.
- CO concentration is above 35 ppm and at or below 1200 ppm.
- H_2S concentration is above 10 ppm and at or below 100 ppm.
- Other potential toxic gas concentrations are above their designated TLV and at or below their IDLH level.
- The work permit is countersigned by a SA division head.

C. Confined space entry is not permitted at concentrations above 23.5% O_2, at or above 50% LEL, above 1,200 ppm CO, above 100 ppm H_2S, or above the IDLH of any other potential toxic gas.

D. These requirements are summarized in Table 6.1.

Table 6.1 Confined Space Entry Requirements

Confined Space Entry	Oxygen (O_2)	Flammable Mixtures	Carbon Monoxide (CO)	Hydrogen Sulfide (H_2S)
Permitted without an atmosphere-supplying respirator	$20\% \leq O_2 \leq 23.5\%$	LEL < 5%	CO ≤ 35 ppm	$H_2S \leq 10$ ppm
Permitted only while continuously wearing an atmosphere-supplying respirator	$O_2 < 20\%$	5% ≤ LEL < 50%	35 < CO ≤ 1,200 ppm	$10 < H_2S \leq 100$ ppm
No entry permitted	$O_2 > 23.5\%$	LEL ≥ 50%	CO > 1,200 ppm	$H_2S > 100$ ppm

6.8 Ventilation

6.8.1 Mechanical ventilation (e.g., air movers) shall be used to ensure the removal of all hazardous airborne contaminants in confined spaces where a hazardous atmosphere exists or could develop during the course of planned work (painting, welding, etc.).

6.8.2 If the confined space is within process equipment or where combustible or flammable material may be present, mechanical ventilation shall be used during the entire period of occupancy, even if gas testing indicates no hazardous concentrations inside the space.

6.8.3 Flammable/toxic gases or vapors vented from a confined space shall be removed in such a manner that the release does not pose a risk to employees, equipment or operations. Precautions shall be taken to eliminate potential sources of ignition in areas where flammable gases or vapors are vented.

6.8.4 Where practical, mechanical ventilation shall provide air blowing into the bottom or lower portion of the confined space and exhaust out the top or upper portion of the space.

6.8.5 Blowers or other means of introducing air into a confined space shall be placed so as to minimize the possibility of introducing air contaminants (e.g., CO).

6.8.6 All electrical and static-producing equipment, including air movers, shall be properly grounded and bonded to the vessel/tank (if applicable).

6.8.7 Mechanical ventilation rates for confined space operations involving application of coating materials, including during the paint curing/drying process, shall meet the minimum requirements of Table 6.2.

Table 6.2 Ventilation Requirements for Confined Spaces

Volume of Confined Space		Required Air Mover Capacity	
m^3	bbl	L/s	cfm
16	100	472	1,000
80	500	1,180	2,500
160	1,000	2,360	5,000
800	5,000	4,720	10,000
1,600	10,000	7,080	15,000
4,000 +	25,000 +	9,440	20,000

6.8.8 Mechanical ventilation/cooling shall be directed at the immediate areas where persons are working within the confined space and shall continue until all person(s) have left the space.

6.8.9 For some jobs, such as welding, grit blasting, spray painting, etc., additional ventilation may be necessary to sufficiently reduce the accumulation of hazardous vapor, mist or particulates. Local exhaust ventilation may also be required for such jobs when the internal configuration of the confined space impedes air circulation.

6.8.10 Plant air or engine-driven compressed air shall never be used for mechanical ventilation.

6.8.11 In lieu of mechanical ventilation, natural ventilation may be used as the source of ventilation in a confined space only if there is no potential for the development of a hazardous atmosphere. Examples of such locations include entries into open excavations or structures, diked areas surrounding tanks, etc.

6.9 Cleaning

6.9.1 Confined spaces shall be cleaned and decontaminated of hazardous materials. Cleaning and decontamination shall be performed to the maximum extent feasible before entry by personnel.

6.9.2 Piping between the confined space and point(s) of isolation shall be drained, cleaned or flushed of hazardous material and hazardous contaminants.

6.9.3 Additional precautions (e.g., more frequent gas testing) shall be taken when cleaning insulated, double-walled, jacketed or lined piping and equipment in confined spaces to avoid contamination from trapped materials. Additional precautions shall be taken when cleaning vessels with chemicals, because they may contain hazardous materials.

6.9.4 The method of cleaning, type of equipment used and safe work procedures shall be selected based on the specific hazards of the confined space.

6.9.5 Prior to entering a confined space that contains unknown residual materials, samples of the materials shall be properly analyzed (e.g., lab analysis) to determine their hazardous characteristics. Whenever possible, samples shall be taken without entering the confined space. See Chapter I-10, *Hazardous Materials*. (Note: Many hazards associated with confined spaces can be attributed to the presence of byproduct sludges, scales, fluids, gases and other residues.)

6.9.6 Hazardous materials, such as pyrophoric waste, shall be disposed of in accordance with GI 430.001. See Chapter I-10, *Hazardous Materials*.

6.9.7 Entrants and equipment shall be decontaminated and cleaned as necessary during and after the confined space activity.

6.10 Training

6.10.1 Confined space entry supervisors, standby men, entrants, etc., shall receive confined space entry training that is appropriate to their specific responsibilities. Refresher training shall be provided periodically.

6.10.2 Confined space entry training and refresher training shall include, but not be limited to, the following topics:

A. The requirements of GI 2.100 and this chapter.

B. The proponent's or contractor's confined space entry program.

C. Hazards associated with confined space entry.

D. Specific responsibilities of entrants, standby men, entry supervisors, rescue personnel, etc. See Section 6.4.

E. Confined space entry permit requirements.

F. Isolation of energy sources per GI 6.012.

G. SAPO or contractor emergency response plans and pre-incident action plans.

H. PPE requirements.

I. Air-line respirator and SCBA training per GI 1780.001.

J. Proper mechanical ventilation techniques and atmospheric gas testing per GI 2.709.

6.10.3 Training for confined space standby men shall also include the following at a minimum:

A. Hazards that may be encountered by entrants and the signs and symptoms of overexposure to potential contaminants inside the confined space.

B. Procedures for summoning rescue or other emergency services.

C. Proper use of equipment used for communicating with entrants and emergency response personnel.

6.10.4 Training for emergency response and confined space rescue personnel shall include the following at a minimum:

A. The SAPO's and/or contractor's pre-incident action plan for each type of confined space they are anticipated to encounter.

B. Emergency response training, including specific training for confined space rescue.

C. Use of emergency rescue equipment and medical equipment expected to be used during a confined space rescue.

D. First aid and basic life support, including cardio pulmonary resuscitation and automated external defibrillator.

Confined Space Entry Checklist

Vessel/Equipment/Confined Space ID:	**Entry Date:**

#	Requirement	Yes	N/A
1.	Confined space entry procedures/instructions provided and available		
2.	Area barricaded and has warning signs posted		
3.	Electrical sources isolated		
4.	Process piping/equipment isolated		
5.	Hydraulic/pneumatic and other energy sources isolated		
6.	Lockout and hold tag procedures followed		
7.	Hot/cold work permit completed		
8.	Confined space entry permit completed		
9.	Atmosphere tested for % oxygen (O_2)		
10.	Atmosphere tested for % LEL		
11.	Atmosphere tested for hydrogen sulfide (H_2S)		
12.	Atmosphere tested for other gases (e.g., CO), identify:		
13.	Gases/chemicals purged, flushed, vented		
14.	Continuous gas testing performed		
15.	Mechanical ventilation provided		
16.	Appropriate personal protective equipment (PPE) provided and used		
17.	Appropriate respirator(s) (e.g., SCBAs) provided and used		
18.	Full-body harness provided and used by each entrant		
19.	Appropriate lighting equipment provided		
20.	Rescue service notified of confined space entry operations		
21.	Rescue equipment (e.g., hoist) available		
22.	Fire extinguisher(s) available at designated entry points		
23.	Standby man continuously present during confined space entry		
24.	Standby man has necessary PPE		
25.	Communications equipment for standby man and entrants provided		
26.	Entry log sheet available at designated entry points and used		

Issuer Name, Signature, Badge #	Receiver Name, Signature, Badge #	Time/Date:

Note: This checklist shall be completed by the Work Permit Issuer and Receiver during their joint site inspection prior to signing each work permit and before allowing confined space entry. The completed checklist shall remain with the Confined Space Standby Man on site after the joint site inspection is complete

CONFINED SPACE ENTRY LOG

UNIT: _____ WORK PERMIT NO.: _____

LOCATION: _____ PAGE: _____ OF _____

STAND-BY MAN: _____ BADGE NO.: _____

NAME OF PERSONNEL ENTERING THE CONFINED SPACE	BADGE #	SIGNATURE	DATE	TIME-IN	TIME-OUT	JOB ASSIGNMENT

7. Fire Prevention

7.1 Purpose

This chapter describes minimum requirements to prevent and protect against fires at work sites, including construction and maintenance work sites. Design of fixed fire protection systems is not covered by this chapter.

7.2 References

Saudi Aramco (SA) General Instructions (GIs):

GI 2.100, *Work Permit System*

GI 6.001, *Notification Requirements for Incidents (Including Fires)*

GI 6.008, *Restriction of Portable Electrical/Electronic Devices*

GI 1781.001, *Inspection, Testing and Maintenance of Fire Protection Equipment*

SA Engineering Standards (SAESs):

SAES-B-017, *Fire Water System Design*

SAES-B-019, *Portable, Mobile and Special Fixed Firefighting Equipment*

SAES-B-067, *Safety Identification and Safety Colors*

SAES-B-068, *Electrical Area Classification*

National Fire Protection Association (NFPA):

NFPA 1, *Fire Code*

NFPA 10, *Portable Fire Extinguishers*

NFPA 30, *Flammable and Combustible Liquids Code*

NFPA 58, *Liquefied Petroleum Gas Code*

NFPA 70, *National Electrical Code*

NFPA 70E, *Electrical Safety in the Workplace*

NFPA 495, *Explosive Materials Code*

7.3 Layout

7.3.1 The following principles of project site layout and organization shall be used to minimize fire risks:

A. Congestion around machinery and equipment shall be avoided, especially where there is a high level of activity and traffic.

B. Operations having a high fire risk, such as welding and open-flame activities, shall be isolated or specially protected from flammable and explosive materials.

C. Adequate emergency access roads shall be provided. Fire department access roads shall not be less than 6 m (20 ft) in width with an unobstructed overhead clearance of not less than 5.5 m (18 ft). Emergency access roads shall not be obstructed at any time.

D. More than one access road shall be provided when emergency access by a single road could be impaired by vehicle congestion, condition of terrain, climatic conditions or other factors.

E. Storage of flammable and combustible materials shall be restricted to the minimum quantities necessary for an uninterrupted cycle of operations or construction activities. A larger, secondary storage site outside the plant/project area shall be used where possible. Storage and handling of flammable and combustible materials shall meet NFPA 30. See Sections 7.7 and 7.8.

F. Work sites shall be provided with the numbers and types of fire extinguishers suitable for the hazards, and as needed to meet the requirements of NFPA 10 and SAES-B-019. Fire extinguishers and other firefighting equipment locations shall be clearly marked on site layout plans. See Section 7.9.

G. A fire prevention inspection checklist shall be used to evaluate construction site and storage yards/areas. See the sample checklist at the end of this chapter.

7.4 Open Yard/Outdoor Storage

7.4.1 Combustible materials shall be neatly stacked, taking into consideration the stability of the stack (pile) and shall in no case be higher than 6 m (20 ft).

7.4.2 Solid combustible materials shall be separated into stacks not larger than 141 m^3 (5,000 ft^3).

7.4.3 Access roads between and around combustible/flammable storage stacks/areas within an outdoor storage yard shall be at least 4.5 m (15 ft) wide and shall be maintained free from accumulation of rubbish, equipment or other material. See Figure 7.2.

7.4.4 Access roads at storage yards shall be spaced at a maximum grid size of 15 m x 45.7 m (50 ft x 150 ft).

7.4.5 Flammable materials (e.g., paints, fuels, chemicals) shall be separated and stored in a designated flammable liquid storage area away from heat sources, electrical equipment and other ignition sources. See Section 7.7 for further information regarding storage of flammable and combustible materials.

7.4.6 Incompatible materials (e.g., flammables and oxidizers) shall not be stored together.

7.4.7 Vegetation (e.g., weeds and grass) shall be kept down and a regular procedure provided for periodic cleanup of the entire area.

7.4.8 Storage areas shall be graded to divert possible spills away from buildings and adjacent working areas, or shall be surrounded by a curb or earth dike at least 30 cm (12 inches) high. Provisions shall be made for draining off accumulations of ground/rain water and spills of flammable/combustible liquids when curbs or dikes are used.

7.5 Indoor Storage

7.5.1 All materials shall be stored and handled according to their fire characteristics.

7.5.2 Incompatible materials that may create a fire hazard shall be segregated by a barrier having a fire resistance of at least 1 hour.

7.5.3 Material shall be stacked to minimize the spread of fire and permit firefighting access. Aisle space shall be maintained to safely accommodate the widest vehicle that may be used within the building for firefighting purposes.

7.5.4 For building areas/rooms without sprinklers, a minimum clearance of 0.6 m (2 ft) shall be maintained between the ceiling and the top level of any stacked material below.

7.5.5 For building areas/rooms with sprinklers, a minimum clearance of 0.5 m (18 inches) shall be maintained between the top level of any stacked material and the sprinkler heads/deflectors.

7.5.6 Adequate clearance shall be maintained around lights and heating units to prevent ignition of combustible materials.

7.5.7 Combustible/flammable materials shall be maintained at a clearance of at least 0.6 m (2 ft) around fire-rated doors.

7.5.8 Materials shall not be stored/located where they obstruct access to exits or visibility of exit signs.

7.6 Control of Ignition Sources

7.6.1 Personnel shall take the precautions necessary to prevent ignition of materials, lubricants, fuels used in the job itself, etc., including as follows:

A. Temporary wiring shall be installed according to the provisions of NFPA 70. See Chapter I-11, *Hand Tools and Power Tools* of this manual.

B. Electrical equipment shall be regularly checked for defects.

C. Ground fault circuit interrupters (GFCIs) shall be provided where required per NFPA 70.

D. Smoking is permitted only in designated areas. "No Smoking" signs shall be prominently displayed, particularly where flammable or combustible materials are stored.

E. Welding equipment, asphalt kettles, heating appliances and other open flames or hot surfaces shall be segregated from flammable and combustible materials.

F. Precautions shall be implemented as needed to control indirect sources of ignition (e.g., hot welding slag falling from a height or sparks from a fire under an asphalt kettle).

G. Open fires and/or open burning of materials are strictly prohibited. Authorization shall be obtained from the SA Fire Protection Department.

H. Proper bonding and grounding techniques shall be used for any operation where static electricity could become an ignition source.

I. Ignition sources shall be immediately removed (e.g., engines shut down) if there is a hydrocarbon liquid or gas leak.

7.6.2 Noncombustible or flameproof welding screens shall be provided around/under cutting, welding or burning operations that are adjacent to or above hydrocarbon operations or flammable/combustible materials.

7.6.3 Any cutting, welding or burning operation requires an assigned qualified fire watch who shall remain in the work area during these activities and for no less than ½ hour after the work has finished.

7.6.4 Temporary enclosures constructed for the protection of operational components and equipment shall be of fire retardant materials.

7.7 Storage of Flammable and Combustible Liquids and Gases

7.7.1 Flammable liquids shall be kept in securely capped metal containers or steel drums upon which the contents are clearly marked.

7.7.2 Gasoline, acetone and other volatile liquids with flash points below 32 °C (90 °F) shall be kept in strong metal lockers located in well-ventilated, noncombustible huts or sheds. Drums containing flammable liquids shall be provided with proper bung vents.

7.7.3 Flammable materials shall not be stored in direct sunlight or in such a manner that they could be subject to heat above their autoignition temperature. Flammable materials may be stored in an open shelter with a roof and walls, provided the walls do not confine heat, smoke, flammable vapors or restrict firefighting access.

7.7.4 Flammable storage areas shall be secured (e.g., locked, fenced) and located at least 15 m (50 ft) away from the nearest building or storage area for other combustibles. No other materials shall be stored with flammable liquids.

7.7.5 Appropriate warning signs (e.g., "Flammable Liquids," "No Smoking," "Flammable – Keep Fire Away"), which shall include an internationally recognized hazard pictogram(s) (see example), shall be posted at flammable storage areas.

7.7.6 Outdoor storage of flammable and combustible liquids shall be in containers that do not exceed 227 L (60 gal) each and they shall not be stored in excess of 4,160 L (1,100 gal) in any one stack (pile) or area. Stacks or groups of containers shall be separated by a 1.5 m (5 ft) clearance and shall be a distance of 6 m (20 ft) from any building or structure.

7.7.7 There shall be a 3.6 m (12 ft) minimum width access way within 60 m (200 ft) of each outdoor stack or area of flammable or combustible containers to permit approach of firefighting apparatus.

7.7.8 Outdoor storage of flammable and combustible materials shall not be within 3 m (10 ft) of a building or structure. Outdoor storage areas shall be kept free of combustible materials for a minimum distance of 9 m (30 ft) from stored flammable/combustible materials.

7.7.9 Indoor storage of flammable and combustible liquids in excess of 95 L (25 gal) shall be contained in flammable liquid storage cabinets (see Figure 7.1) or specially designed rooms/buildings meeting the requirements of NFPA 30. No more than 95 L (25 gal) of flammable/combustible liquids shall be stored in an enclosed room outside of an approved flammable storage cabinet.

Figure 7.1 Painted Steel Flammable Storage Cabinet

7.7.10 No more than 227 L (60 gal) of flammable liquids and no more than 454 L (120 gal) of combustible liquids shall be stored in a single storage cabinet. Not more than three cabinets shall be located in a single storage area. All cabinets shall be grounded.

7.7.11 Flammable storage cabinets shall be properly labeled in noticeable lettering: "Flammable - Keep Fire Away" with internationally recognized hazard pictogram(s).

7.7.12 Flammable or combustible liquids shall not be stored in areas used for exits, stairways or in areas normally used for the safe passage of people.

7.7.13 Flammable gas cylinders (e.g., acetylene, propane) shall be segregated from other materials and preferably stored under an open, well-ventilated sun shade. Oxidizing gases (e.g., oxygen, chlorine) shall be stored separately. See Chapter I-9, *Compressed Gas Cylinders*, of this manual.

7.8 Handling of Flammable and Combustible Liquids and Gases

7.8.1 The following precautions shall be observed when handling flammable and combustible liquids:

A. Flammable and combustible liquids shall always be transported in closed metal containers. Plastic containers are prohibited for the storage of flammable and combustible liquids.

B. All containers of flammable and combustible liquids, whether at operational facilities, construction sites or inside buildings, shall be properly labeled. See Chapter I-10, *Hazardous Materials*, of this manual.

C. Containers holding a flammable liquid shall be Factory Mutual (FM) approved or Underwriters' Laboratories (UL) listed and labeled as such.

D. Portable gasoline containers shall be placed on the ground during filling and shall never be placed inside vehicle passenger compartments.

E. Containers shall be recapped immediately after use.

F. Gasoline shall not be used as a cleaning agent.

G. Gasoline- and diesel-powered equipment shall only be refueled in well-ventilated areas. Exhaust pipes shall be kept away from combustible/flammable materials. Engines shall be stopped before refueling takes place.

H. Areas where flammable or combustible liquids are transferred from one tank or container to another tank or container in quantities greater than 19 L (5 gal) shall be separated from activities that are a source of ignition (e.g., welding, grinding) by a distance of 7.6 m (25 ft) or by a barrier having a fire resistance of at least 1 hour. There shall be no open flames within 15 m (50 ft) of the transfer operation unless conditions warrant greater clearance.

I. Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable/combustible vapor being transferred/handled at or below 10% of the lower explosive limit (LEL).

J. Containers shall be grounded and bonded during transfer of flammable or combustible liquids.

K. Cellular/mobile phones or other electronic devices shall not be used when transferring flammable liquids or when refueling vehicles.

7.8.2 Metallic parts (e.g., nozzles, fittings) of vacuum hoses, suction hoses, pumping equipment, inert gas hoses, steam lines, etc., when used in the cleaning or ventilation of tanks and vessels that contain hazardous concentrations of flammable gases or vapors, shall be bonded to the tank or vessel shell. Bonding devices shall not be attached or detached in hazardous concentrations of flammable gases or vapors.

7.8.3 Storage, handling and use of liquefied petroleum gas (LPG) shall comply with the requirements of NFPA 58 and Chapter I-9, *Compressed Gas Cylinders*, of this manual.

7.9 Portable Firefighting Equipment

7.9.1 Appropriate portable and mobile firefighting equipment shall be located in accordance with SAES-B-019 and as needed to address job site hazards (e.g., hot work activities). See Table 7.1 at the end of the chapter for more information on portable fire extinguishers.

7.9.2 Firefighting equipment shall be located at convenient, conspicuous locations and be easily accessible.

7.9.3 For flammable/combustible liquid storage areas located outdoors, portable fire extinguisher(s) suitable for the fire hazard involved shall be located not less than 7.6 m (25 ft) nor more than 23 m (75 ft) from the fire hazard.

7.9.4 For storage areas located outdoors without flammable or combustible liquids, portable fire extinguisher(s) suitable for the fire hazard involved shall be located so that maximum travel distance to the nearest unit does not exceed 30 m (100 ft).

7.9.5 Firefighting equipment shall be maintained in good working order and be protected from harsh environmental conditions as needed (e.g., cover wheeled fire extinguishers).

7.9.6 The area around firefighting equipment (e.g., fire extinguishers, fire hydrants) shall be kept clear so that they are readily accessible in case of an emergency.

7.9.7 All applicable personnel (including contractor personnel) shall be aware of the firefighting equipment available on-site and shall be trained in its use.

7.10 Inspection and Maintenance of Fire Protection Systems and Equipment

7.10.1 Fire protection systems and equipment, whether temporary or permanent, shall be inspected and maintained in accordance with GI 1781.001.

7.10.2 Equipment inspection records shall be maintained (an inspection log book and equipment inspection tags shall be used at a minimum) and made available for review upon request by SA.

7.10.3 Any fire protection system component or firefighting equipment that does not pass inspection shall be immediately replaced or repaired.

7.10.4 Safety red shall be the identification color for all fire protection equipment per SAES-B-067.

7.11 Housekeeping

7.11.1 Waste shall be removed from the work site at regular intervals and at the end of each work day.

7.11.2 Storage of combustible materials shall not be allowed underneath buildings or stairways.

7.11.3 Metal bins with close-fitting lids shall be provided and used for disposal of oily rags, wood shavings and other highly combustible waste. Oily rags shall not be disposed of in the same container as other combustible waste.

7.11.4 Contents of ash trays shall not be mixed with other combustible or flammable waste.

7.11.5 Noncombustible absorbents shall be used to remove oil spills or leaks.

Table 7.1 Fire Extinguisher Types

	Potassium Bicarbonate (Purple K) Cartridge Operated	Water Type Stored Pressure	Carbon Dioxide (CO_2) Stored Pressure	Multi-Purpose ABC Dry Chemical Cartridge Operated
Class A Fires Ordinary combustibles (wood, paper, trash, etc.)	No	Yes	No	Yes
Class B Fires Flammables and combustibles (e.g., gasoline, oil, paint, grease)	Yes	No	Yes	Yes
Class C Fires Energized electrical equipment	Yes	No	Yes	Yes
Range	1.5-6 m (5-20 ft)	9-12 m (30-40 ft)	1-2.4 m (3-8 ft)	1.5-6 m (5-20 ft)
SA Material Number (MN)	1000124972 (125 lb. Wheeled) 1000124945 (30 lb. Type)	1000124949	1000808216	1000124942

Inspection: Inspections of fire extinguishers shall be performed monthly by the SA proponent organization in compliance with GI 1781.001, *Inspection, Testing and Maintenance of Fire Protection Equipment*, Supplement 1. Contractor shall perform inspections if proponents are not normally on-site.

During inspections check if extinguisher is in correct location, access is unobstructed and extinguisher is clearly visible. Check contents gauges, where fitted, to see if extinguisher is usable. Check for signs of leakage, corrosion or physical damage. Check if seals are unbroken and up-to-date inspection tag is fitted. If in doubt, contact your local Fire Control Unit.

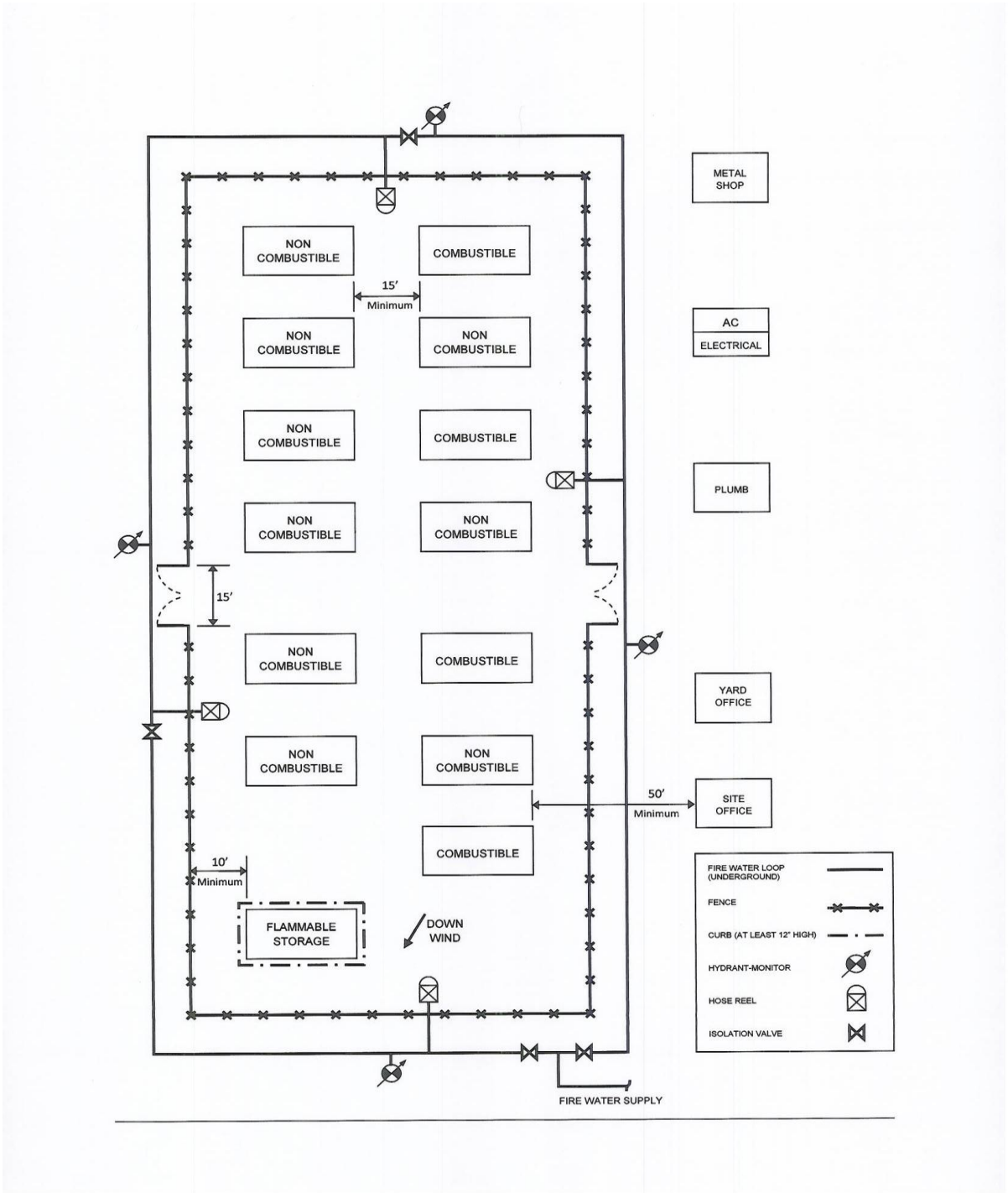


Figure 7.2 Typical Construction Materials Storeyard

Sample Fire Prevention Inspection Checklist

Facility:	Plant/Unit:
Completed By:	Date/Time:

Yes	No	Condition
		Housekeeping
☐	☐	• Construction materials storage orderly
☐	☐	• Combustible scrap/trash removed regularly
☐	☐	• Metal containers with covers provided for disposal of oily or paint-soaked rags
		Smoking
☐	☐	• NO SMOKING signs posted
☐	☐	• NO SMOKING regulations enforced
		Electrical
☐	☐	• Temporary wiring installed per NEC
☐	☐	• Wiring and connections to junction boxes, panels, equipment, etc., in good condition
☐	☐	• Overcurrent protective devices (fuses, circuit breakers) in good condition
☐	☐	• GFCIs provided where required
		Welding and Cutting
☐	☐	• Welding, cutting, or brazing in progress?
☐	☐	• Any combustible materials exposed by these operations
☐	☐	• Fire watch provided during, and for at least 30 minutes after, these operations
☐	☐	• Portable fire extinguisher or fire hose available where operations are carried on
		Flammable/Combustible Liquids
☐	☐	• Flammable/combustible liquids stored and dispensed in a satisfactory manner
☐	☐	• Adequate ventilation provided where flammables and other chemicals are in use
		Exits
☐	☐	• Fire exits unobstructed, including access ways and discharge areas
☐	☐	• All exits clearly marked
☐	☐	• All exits adequately lighted
☐	☐	• Stair exit fire doors in good operating condition
☐	☐	• Adequate egress provided from uppermost work areas
		Construction Offices, Trailers, Sheds
☐	☐	• Combustible offices, trailers, and sheds located at least 10 m (30 ft) away from major buildings and materials storage
☐	☐	• Heating devices in offices, trailers, and sheds "approved" type
☐	☐	• Heating devices properly installed and vented
☐	☐	• Fuel cylinders/lines for heating devices protected against vehicular damage

Yes	No	Condition
		Extinguishers and Small Hose
☐	☐	• Sufficient portable extinguishers of the proper type provided throughout
☐	☐	• Extinguishers and small hoses kept in good operating condition
☐	☐	• Equipment unobstructed and location highlighted
☐	☐	• Equipment protected from rain, dust, construction activity, paint spray, etc.
☐	☐	• Selected personnel trained to operate extinguishers and small hose
		Sprinkler Systems
☐	☐	• Sprinkler installation progressing with construction
☐	☐	• Sprinkler control valves accessible, labeled and open where necessary
☐	☐	• Sprinkler alarms in service
☐	☐	• Sprinkler system pumper connections clearly marked and accessible to Fire Dept
		Hydrants
☐	☐	• Hydrants unobstructed and accessible to Fire Department
☐	☐	• Hydrants in good operating condition
		Standpipes
☐	☐	• Standpipe systems installed and in service up to highest level of operations
☐	☐	• Standpipe hose connections unobstructed and accessible to Fire Department
☐	☐	• Standpipe pumper connections clearly marked and accessible to Fire Department
		Fire Alarms
☐	☐	• Standard procedure established for reporting a fire
☐	☐	• All workers instructed in this procedure
☐	☐	• Audible alarm in operation to alert workers of a fire on the site
☐	☐	• Emergency communication capability located nearby
☐	☐	• Has the Fire Department visited the site during the past month?
		Tarpaulins
☐	☐	• Are tarpaulins used for cover/enclosure?
☐	☐	• Tarpaulins in use flame-resistant type
☐	☐	• Tarpaulins in use tightly secured to prevent contact with ignition sources
		Other:

8. Traffic and Vehicle Safety

8.1 Purpose

This chapter describes minimum requirements for operating motor vehicles within areas under Saudi Aramco (SA) jurisdiction, including driver performance and vehicle maintenance.

8.2 References

SA General Instructions (GIs):

GI 6.005, *Reporting, Investigation and Recording of Injuries/Occupational Illnesses*

GI 6.007, *Reporting of Contractor On-Job Injuries/Occupational Illnesses*

GI 6.025, *Control of Remote Area Travel and Search/Rescue Procedures*

GI 6.029, *Reporting and Recording of Motor Vehicle Accidents*

GI 6.030, *Traffic and Vehicle Safety*

GI 150.002, *Basic Life Support (BLS) Heartsaver Automated External Defibrillator (AED) / Standard First Aid (SFA) and First Aid Kit*

GI 710.007, *Restricted and Non-Restricted Area Vehicle Access Stickers*

SA Safety Handbook, *Minimum Safety Rules*

8.3 General Requirements

8.3.1 Only authorized drivers (SA or contractor) shall operate motor vehicles. Operator credentials shall be verified prior to their being allowed to operate motor vehicles.

8.3.2 Drivers operating motor vehicles (either SA owned/leased or contractor owned/leased) on highways and company property and/or work sites shall have in their possession a valid Saudi Arabian Government (SAG) driving license.

8.3.3 Drivers shall complete and pass the SA Driver Improvement Program (or SA-approved equivalent) and shall have completed the Driver Improvement Refresher Seminar within the period stipulated in GI 6.030.

8.3.4 Drivers (SA and contractor) shall be held accountable for the safe operation of the vehicle.

8.3.5 Drivers shall:

A. Abide by all SAG traffic regulations and SA traffic requirements at all times in all locations.

B. Wear seat belts at all times and ensure that all passengers wear their seat belts as well.

C. Report any damage immediately to their supervisor.

D. Perform a 360-degree walk around before getting into the vehicle.

E. Ensure the vehicle is safe to operate and contains all required safety equipment prior to use.

F. Ensure the vehicle is properly equipped before operating in remote locations.

G. Not exceed the posted speed limit at any time.

H. Not use a cell phone, eat or drink while driving.

I. Properly transport materials and ensure loads do not exceed the vehicle manufacturer's design load capacity. Loads shall be properly secured and tied down. Materials shall not extend over the sides of the vehicle. Loads extending beyond the front or rear shall be marked with a red flag and trailers shall be equipped with visible brake and taillights.

J. Secure loose materials in the driving compartment or truck cargo area. Hard hats and other loose materials shall not be placed on the rear window shelf.

K. Ensure unauthorized persons are not transported in vehicles.

L. Not transport more passengers than the number of seat belts provided in the vehicle.

M. Not transport passengers in the rear of pickups or on truck beds.

N. Only park in designated parking areas. Parked vehicles shall not obstruct other vehicles, roadways, access ways or fixed firefighting installations.

O. Reduce vehicle speed under hazardous weather or road conditions (see GI 6.030).

P. Not leave the vehicle unattended while the engine is running.

Q. Always set the parking or emergency brake when the vehicle is parked.

8.3.6 All vehicles entering a SA restricted area (e.g., hydrocarbon facility, refinery, gas plant, terminal) shall have a valid, SA Transportation

Department inspection sticker. See SA Form 7573, *Restricted Area Access Sticker Request*.

8.3.7 Vehicles shall be re-inspected when its SA inspection sticker expires. If the vehicle fails inspection due to mechanical reasons, it shall be repaired and inspected before a new sticker is issued.

8.3.8 All motor vehicles shall be serviced and repaired according to the manufacturer's maintenance schedule.

8.4 Vehicle Inspection

8.4.1 Drivers shall inspect vehicles on a monthly basis using a detailed inspection checklist. The checklist items shall cover, but not be limited to, the availability and/or condition of:

A. Two reflective warning triangles.

B. Windows, windshields, inside and outside rearview mirrors and windshield wipers.

C. Headlights, taillights, brake lights, turn signal lights, horn, etc.

D. Foot and emergency brakes.

E. Tires, wheels, spare tire(s) and jack and wrench.

F. Vehicle fluids (e.g., radiator coolant*, oil, brake fluid, transmission oil [checked with engine running], steering fluid, wiper washer water, and distilled water for the battery).

*NOTE: The driver shall check the radiator coolant level only when the engine is cool. When necessary, coolant shall be added to the level marked on the overflow expansion tank, if provided.

8.5 Motor Vehicle Accidents

8.5.1 Motor vehicle accidents (MVAs) that occur on SA premises or SA project sites shall be reported to the nearest SA Industrial Security Control Center by telephone, radio or messenger.

8.5.2 The driver shall immediately inform his supervisor of an MVA, after meeting the requirements of SA Industrial Security and/or SAG police.

8.5.3 Drivers shall not leave the scene of an incident or move the vehicle after a collision until released by the SAG police officer or a SA Industrial Security representative.

8.5.4 Reflective triangles shall be used to warn approaching traffic if a damaged vehicle is blocking traffic or is stopped on the road.

8.5.5 GI 6.029 lists further instructions and procedures that shall be followed.

8.6 Desert Driving (Off-Road Driving)

8.6.1 Off-road vehicle operators shall receive specific training in off-road driving and survival techniques. Contractor companies shall provide their own training and testing for off-road travel.

8.6.2 Off-road vehicle operators shall inform their immediate supervisors of their destination, route and expected time of return.

8.6.3 A sign-in/sign-out logging system shall be used. Refer to GI 6.025 for details of the information to be recorded.

8.6.4 Personnel lost or stranded in the desert shall stay with the vehicle.

8.6.5 Off-road vehicles shall be in good condition and, as a minimum, equipped with the following (refer to GI 6.025 for further details):

A. Compass and/or global positioning system (GPS) unit and appropriate maps.

B. Adequate spare fuel and oil.

C. Communication equipment.

D. Tools and equipment for emergency use (shovel, sand boards/mats, rope, sling, shackles, etc.) and two properly inflated spare sand tires.

E. Sufficient food and drinking water to last until rescue occurs, if stranded.

F. Sufficient materials to create shade.

9. Compressed Gas Cylinders

9.1 Purpose

This chapter describes minimum requirements for safe storage, handling and transportation of compressed gas cylinders.

9.2 References

Saudi Aramco (SA) Engineering Standards (SAESs):

SAES-B-055, *Plant Layout*

SAES-B-067, *Safety Identification and Safety Colors*

SA Safety Handbook, *Minimum Safety Rules*

SA Supply Chain Management Manual

CU 22.01, *Dangerous Goods: Processing and Handling Gas and Gas Cylinders*

National Fire Protection Association (NFPA):

NFPA 70, *National Electrical Code*

9.3 General Requirements

9.3.1 Compressed gas cylinders shall be properly marked or labeled, including their contents, with lettering in Arabic and English as per SAES-B-067 and CU 22.01. This includes all industrial, medical, laboratory and aviation bottled gases.

9.3.2 The supplier's identification tag shall be used to verify the contents of a cylinder.

9.3.3 Cylinders shall not be placed in confined spaces or adjacent to excavations.

9.3.4 Cylinders shall be inspected for damage, severe corrosion, valve leakage and current hydrotest date prior to each use.

9.3.5 Damaged or defective cylinders shall not be used.

9.3.6 A leaking cylinder shall be immediately removed to an open space, clear of all buildings, people and any potential source of ignition.

9.3.7 All cylinders shall have an approved pressure-reducing regulator with check valve connected to the cylinder valve.

9.3.8 Regulators shall be closed (adjusting screws backed out) prior to connection to the cylinder valve.

9.3.9 The cylinder valve shall always be opened slowly to prevent damage to the regulator.

9.3.10 Valves on cylinders shall not be opened more than 1½ turns.

9.3.11 Threads on fittings shall correspond to cylinder valve outlets.

9.3.12 The cylinder valve shall always be closed before attempting to stop a leak.

9.3.13 Oil, grease or other hydrocarbons shall not be used as a lubricant on valves, fittings or threaded attachments.

9.3.14 Hose connections shall be kept free of grease and oil.

9.3.15 Compressed gas cylinders used for oxygen-fuel welding and cutting shall be per Chapter II-10, *Cutting, Welding and Brazing*, of this manual.

9.4 Storage

9.4.1 Cylinders shall be stored in a safe and accessible location. Cylinder storage locations shall be a dry, well-ventilated area prepared and reserved for that purpose.

9.4.2 Location and/or spacing requirements for cylinder storage areas shall be in accordance with SAES-B-055.

9.4.3 Flammable/combustible substances (e.g., oil, grease, volatile liquids) and corrosive substances shall not be stored in the same area as gas cylinders.

9.4.4 Oxygen cylinders and cylinders containing other oxidizers (e.g., chlorine, nitrous oxide) shall be stored at least 6.1 m (20 ft) from flammable gas cylinders or they shall be separated by a ½-hour fire rated barrier at least 1.5 m (5 ft) high.

9.4.5 Smoking and other sources of ignition are prohibited near storage areas.

9.4.6 Storage areas shall have Arabic and English "No Smoking" and "Gas Cylinder Storage Area" signs prominently displayed per SAES-B-067 and CU 22.01.

9.4.8 Cylinders shall be chained or otherwise secured in an upright position; use bottle/cylinder racks wherever possible.

9.4.9 Cylinders stored in the open shall not have direct contact with the ground, exposure to extreme weather or contact with water.

9.4.10 The quantity of cylinders shall be kept to a minimum at job site locations. Bulk storage (e.g., large inventories) shall be located off-site.

9.4.11 When regulators are removed from the cylinders, they shall be considered "not in use" or "stored" and cylinder valve caps shall be put back in place.

9.4.12 Water and dry chemical fire extinguishers shall be immediately available within 15 m (50 ft) of the storage area.

9.4.13 Cylinders shall not be stored at temperatures or locations that could result in the temperature of the cylinder exceeding 54 °C (130 °F). Outside cylinder storage areas shall have protective enclosures or sun shelters installed as needed to prevent cylinders from reaching 54 °C (130 °F).

9.4.14 Cylinders shall not be stored in a location where they would be subject to direct flames or other heat sources, such as furnaces.

9.4.15 Cylinder storage shall be arranged so that cylinders are used in the order in which they are received from the supplier.

9.4.16 Empty and full cylinders shall be stored separately with empty cylinders plainly marked to avoid confusion.

9.4.17 Cylinders (empty and full) shall be segregated according to the type of gas they contain.

9.5 Storage Rooms

9.5.1 Cylinder storage rooms shall be sufficiently ventilated so that explosive concentrations of gas cannot accumulate.

9.5.2 Electrical systems (wiring, connections, conduits, lighting fixtures, etc.) in cylinder storage rooms shall meet *National Electrical Code* (NFPA 70) requirements for hazardous areas.

9.6 Handling of Cylinders

9.6.1 A cylinder shall never be lifted by its valve.

9.6.2 A protective cap shall remain on the valve when the cylinder is not in use.

9.6.3 A cylinder's valve shall be fully closed before a cylinder is moved.

9.6.4 Unless a trolley or special carrier is used, regulators and hoses shall be detached and cylinder valve caps put back in place before moving.

9.6.5 If cylinders are to be lifted by a crane, specially designed bottle carriers with lifting eyes shall be used. Cylinders shall not be lifted with electromagnetic devices, slings, chains or ropes.

9.6.6 Cylinders shall not be struck together, dropped, thrown, dragged, used as rollers or as a support.

9.6.7 Cylinders involved in a fire shall be returned immediately to the supplier, alerting the supplier that the cylinders were exposed to a fire.

9.6.8 Cylinders, even those marked empty, shall be treated as a possible hazard and handled with great care. No cylinder is completely empty of gas.

9.6.9 Personnel handling toxic gas cylinders shall be trained in the hazards of the gas they are handling and how to use a self-contained breathing apparatus (SCBA).

9.6.10 Empty cylinders shall be returned to the supplier with the valves closed and cylinder valve caps in place.

9.7 Transportation

9.7.1 Cylinder trolleys, material baskets, cylinder racks and other proper types of equipment shall be used to transport cylinders.

9.7.2 All cylinders being transported by vehicle shall have cylinder valve caps in place, be positioned in an upright position and be firmly secured to prevent movement.

9.7.3 Vehicles transporting cylinders shall be equipped with the required firefighting and first aid equipment.

10. Hazardous Materials

10.1 Purpose

This chapter describes minimum requirements for the safe use, handling, storage and disposal of hazardous materials.

10.2 References

Saudi Aramco (SA) General Instructions (GIs):

GI 2.100, *Work Permit System*

GI 2.709, *Gas Testing Procedure*

GI 150.001, *Asbestos Hazard Management*

GI 150.100, *Hazardous Materials Communication (HAZCOM) Program*

GI 150.110, *Periodic Occupational Physical Examination Programs*

GI 430.001, *Waste Management*

GI 1780.001, *Atmosphere-Supplying Respirators*

SA Engineering Standards (SAESs):

SAES-B-067, *Safety Identification and Safety Colors*

SAES-B-069, *Emergency Eyewashes and Showers*

SA Engineering Procedure (SAEP):

SAEP-358, *Management of Technologically Enhanced Naturally Occurring Radioactive Material (NORM)*

SA Chemical Hazard Bulletins (CHBs)

American National Standards Institute (ANSI)/American Society of Safety Engineers (ASSE):

ANSI/ASSE Z390.1, *Accepted Practices for Hydrogen Sulfide (H_2S) Training Programs*

National Fire Protection Association (NFPA) Standard:

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*

10.3 General Requirements

10.3.1 When using/handling potentially harmful chemicals or hazardous substances, precautions shall be taken to ensure that personnel do not swallow, inhale or allow it to contact their skin.

10.3.2 Hands shall be washed thoroughly after handling chemicals or hazardous substances.

10.3.3 Personnel shall be trained to remove contaminated clothing, promptly flush affected areas with clean water for at least 15 minutes and seek medical attention when harmful chemicals contact the skin or eyes.

10.3.4 Chemicals shall not be subjected to undue physical shock, pressure or heat.

10.3.5 Excess chemicals no longer needed shall be safely disposed of or recycled per GI 430.001.

10.3.6 Personal protective equipment (PPE), including respiratory protection equipment, as stipulated in the relevant Material Safety Data Sheet (MSDS) or Chemical Hazard Bulletin (CHB), shall be used when working with chemicals or hazardous substances. See Chapter I-3, *Personal Protective Equipment (PPE)*, of this manual.

10.3.7 When handling volatile liquids, the threshold limit value (TLV) of the vapor shall be determined and not exceeded. When exhaust ventilation is unavailable, good mechanical ventilation shall be provided or the work shall be performed outdoors.

10.3.8 Exhaust ventilation, fans, blowers and proper handling procedures shall be used to keep personnel from breathing hazardous vapors and/or dust. Respiratory protection shall be provided and used when necessary.

10.3.9 Respiratory protection equipment shall be used when chemical concentrations in air exceed the TLV.

10.3.10 Equipment, piping or filter cartridges containing pyrophoric materials (e.g., iron sulfide) shall be kept wet to prevent spontaneous ignition upon opening of equipment and contact with air.

10.3.11 Emergency eye wash stations and showers shall:

A. Be provided when eyes or skin may be exposed to chemicals or hazardous substances.

B. Be installed and maintained per SAES-B-069.

10.3.12 Only the necessary amount of hazardous materials shall be stored at the job site, usually not more than a 1-day supply.

10.3.13 Hazardous materials shall not be allowed to accumulate. Extra amounts shall be removed from the work area.

10.3.14 Waste (e.g., slop liquids and trash) shall be immediately removed from the work area.

10.3.15 Smoking and use of devices not classified as explosion proof are prohibited near flammable liquids or finely divided combustible solids.

10.3.16 Fire extinguishers shall be available. See Chapter I-7, *Fire Prevention*.

10.4 Identification and Labeling

10.4.1 All materials or substances (gas, liquid or solid) produced in or brought into a facility or project site shall be identified and evaluated for their potential physical or health hazards.

10.4.2 The SA proponent organization (SAPO) and/or contractor company shall prepare a complete inventory of all current chemicals and products (e.g., liquids, solids, powders, pastes, gases) at the facility or project site.

10.4.3 For construction or maintenance projects, the inventory shall be prepared at the beginning of the project and each quarter thereafter until project completion. All inventory sheets shall be forwarded to the SAPO and maintained on file until completion of the project.

10.4.4 Each container of hazardous material shall be properly labeled to indicate its contents and hazards (see Figure 10.1 for an example). Hazardous materials received at a facility or project site without proper labels shall be set aside and not distributed for use until properly labeled. See GI 150.100 for typical hazardous chemical labels.

10.4.5 Portable containers into which hazardous chemicals are transferred that are intended only for use by the employee who performs the transfer shall also be identified as to their contents (e.g., acetone, gasoline).

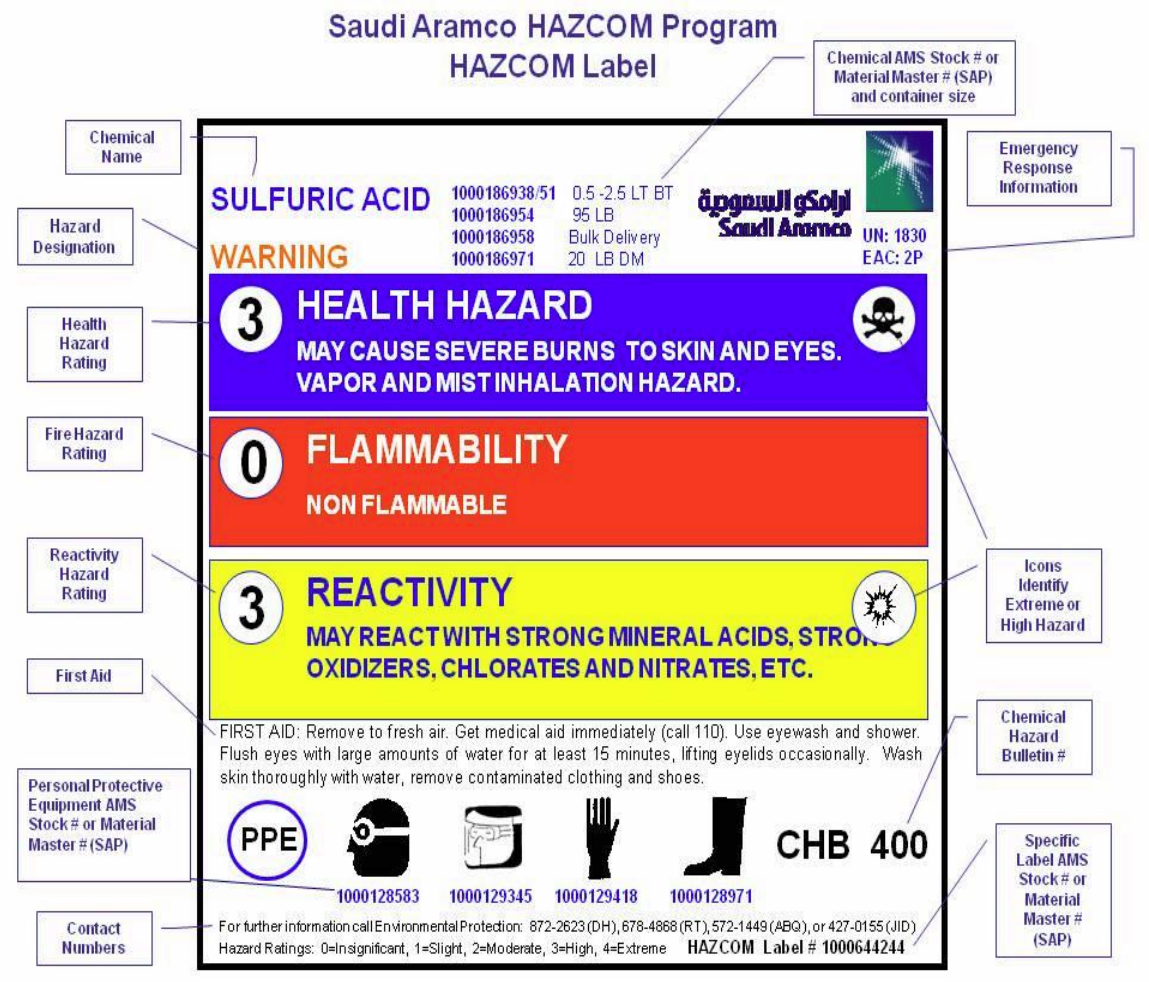

Saudi Aramco HAZCOM Program
HAZCOM Label
Chemical AMS Stock # or Material Master # (SAP) and container size
Chemical Name
Emergency Response Information
Hazard Designation
SULFURIC ACID
WARNING
1000186938/51 0.5 -2.5 LT BT
1000186954 95 LB
1000186958 Bulk Delivery
1000186971 20 LB DM
Saudi Aramco
UN: 1830
EAC: 2P
Health Hazard Rating
3 HEALTH HAZARD
MAY CAUSE SEVERE BURNS TO SKIN AND EYES.
VAPOR AND MIST INHALATION HAZARD.
Fire Hazard Rating
0 FLAMMABILITY
NON FLAMMABLE
Reactivity Hazard Rating
3 REACTIVITY
MAY REACT WITH STRONG MINERAL ACIDS, STRONG OXIDIZERS, CHLORATES AND NITRATES, ETC.
Icons Identify Extreme or High Hazard
First Aid
FIRST AID: Remove to fresh air. Get medical aid immediately (call 110). Use eyewash and shower. Flush eyes with large amounts of water for at least 15 minutes, lifting eyelids occasionally. Wash skin thoroughly with water, remove contaminated clothing and shoes.
Chemical Hazard Bulletin #
Personal Protective Equipment AMS Stock # or Material Master # (SAP)
PPE
CHB 400
1000128583
1000129345
1000129418
1000128971
Specific Label AMS Stock # or Material Master # (SAP)
Contact Numbers
For further information call Environmental Protection: 872-2623 (DH), 678-4868 (RT), 572-1449 (ABQ), or 427-0155 (JID)
Hazard Ratings: 0=Insignificant, 1=Slight, 2=Moderate, 3=High, 4=Extreme
HAZCOM Label # 1000644244

Figure 10.1 Example Hazardous Material Label

10.4.6 Labels shall be prominently located on each container of hazardous material so as to be legible while the container is in the upright position.

10.4.7 Labels on containers exposed to direct sunlight and/or adverse weather shall be periodically inspected to verify that the label is clear and conspicuous and has not been damaged or destroyed.

10.4.8 If a labeled container is covered by a secondary container or a covering that remains in place while the contents of the container are withdrawn or used, the required labels shall also appear on the secondary container or covering.

10.4.9 Containers of mixtures shall be labeled with the common name and listed hazards of the mixture or with the chemical name listed on the CHB/MSDS for each toxic or hazardous substance in the mixture.

10.4.10 Unlabeled containers found in the workplace shall be tested and properly labeled or disposed of per GI 430.001.

10.5 Material Safety Data Sheets/Chemical Hazard Bulletins

10.5.1 Complete and current MSDSs/CHBs for each chemical or hazardous substance stored/used on site shall be readily accessible (e.g., at the location of the material storage or handling areas) to employees and contractors and to emergency response personnel (e.g., firefighters, security personnel, emergency medical personnel). See Figure 10.2 for an example of a CHB.

CHEMICAL HAZARD BULLETIN NO. 8

Saudi Aramco

HYDROCHLORIC ACID (Muriatic Acid; Oakite No.32)

1000183210	2.5 LT BT
1000183167/232	500 ML BT
1000183214	49 LT CO
1000183218	Bulk Delivery
1000186657/687	1 GA DM
1000253977	20 GA DM

Health	3
Fire	0
Reactivity	3

COLORLESS TO SLIGHTLY YELLOW LIQUID
HIGHLY TOXIC, NON-FLAMMABLE, HIGHLY REACTIVE
HIGHLY IRRITATING CORROSIVE VAPORS
FORM IN MOIST AIR

CAS: 7647-01-0
UN: 1789
GUIDE: 157

LIQUID/VAPOR:	Both the TLV and PEL have a Ceiling of 5ppm for this strong acid.	health hazards
INHALATION:	**EFFECTS OF OVEREXPOSURE:** Atmospheric levels of 1.5ppm are irritating. Above 35ppm it causes severe eye, nose and throat irritation. Levels about 100ppm are immediately hazardous to life.	
EYE/SKIN:	Severely burns eyes and skin.	
INGESTION:	Swallowed will corrode lining of mouth, throat and stomach and may be fatal.	
	WEAR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT	

Hydrochloric acid does not burn but flammable hydrogen gas is produced on contact with common metals. Fire fighters MUST wear full protective suit, gloves and Scott Air Pak (21-311-231).	fire and reactivity
REACTIVITY: Avoid contact with metals, ethylene, ammonia, lye and sulfuric acid. Reacts with water or steam to produce toxic and corrosive vapors.	
EXTINGUISH FIRES WITH DRY CHEMICAL OR FOAM	

USES:	Primarily for acidizing oil wells and cleaning boilers or other refinery equipment.	handling storage & disposal
STORAGE:	Post storage area with "DANGER ACID" sign. Store away from incompatible materials listed in the reactivity section.	
TRANSPORT:	For transportation, label packages with DOT-IMO Class 8, hazardous warning label (diamond): CORROSIVE.	
SPILLS/LEAKS:	Always wear full protective clothing and air-supplied breathing apparatus.	
DISPOSAL:	For proper disposal methods and locations for the chemical or chemical contaminated material, contact the Environmental Engineering Division at 874-6428.	
SAFETY EQUIPMENT:	Keep Scott Air Pak (1000127427) available for emergencies. Maintain an eyewash fountain and emergency shower (1000128433) where the acid is stored/used. Wear goggles (1000129628), coveralls (1000129180), boots (1000128971) and protective gloves (1000129628) where eye or skin contact is likely.	
	USE CONFINED SPACE ENTRY PROCEDURES IF APPLICABLE	

INHALATION:	Poisonous: irritates throat and eyes. Move victim to fresh air. If breathing has stopped, wash victim's face quickly and give artificial resuscitation.	first aid
EYE/SKIN CONTACT:	Place victim into emergency shower at once. If in eyes, hold eyelids open and flush with water for 15 minutes.	
INGESTION:	If swallowed and victim is conscious, give victim water. Do NOT induce vomiting.	
	GET MEDICAL AID IMMEDIATELY (CALL 110)	

For further information call Industrial Hygiene: 872-2623 (DH), 678-4902 (RT), 572-3553 (ABQ) or 427-2217 (JID)
Hazard Ratings: 0=Insignificant, 1=Slight, 2=Moderate, 3=High, 4=Extreme

Revised:4/12/2003

Figure 10.2 Sample CHB

10.5.2 CHBs printed directly from the SA Environmental Protection Department (EPD) HAZCOM intranet site shall be printed in color to properly show the color-coded hazard ratings.

10.5.3 SA and contractor employees shall be provided with effective training on the proper use and precautions for hazardous materials in their work area. This training shall be at the time of their initial assignment and whenever a new hazardous material that the employees have not previously been trained on is introduced into their work area. Chemical-specific information identified from labels, MSDSs and/or CHBs shall be included in this training, which shall be documented.

10.6 Transportation, Storage and Disposal

10.6.1 Hazardous materials shall be protected against shock, incidental mixing with other materials, damage to containers, undue heat from the sun or other sources, and theft during transportation.

10.6.2 Vehicles transporting hazardous materials shall be suitably labeled as such and shall not be left unattended. Drivers shall have copies of the MSDS(s) and/or CHB(s) for the material(s) being transported with them at all times.

10.6.3 Specific storage and handling recommendations for hazardous materials provided in MSDSs and/or CHBs shall be followed.

10.6.4 MSDSs and/or CHBs shall be referenced to identify which chemicals are reactive to each other prior to transportation or storage.

10.6.5 Chemicals shall not be allowed to inadvertently mix with other substances during transportation, storage or use.

10.6.6 Incompatible chemicals shall not be stored near each other or be mixed together. Reactive substances shall not be stored near flammable or corrosive materials.

10.6.7 Combustible and flammable materials shall be stored in accordance with Chapter I-7, *Fire Prevention*.

10.6.8 Chemical containers in storage cabinets shall be inspected periodically for container integrity.

10.6.9 Toxic substances shall be segregated in well-identified areas with proper exhaust ventilation.

10.6.10 Hazardous materials shall be stored in containers that are safe for storage, transportation and use.

10.6.11 Empty hazardous material containers shall be washed free of the material or destroyed. Liquids used to wash containers shall be properly disposed of as liquid hazardous waste in accordance with GI 430.001.

10.6.12 Spills shall be promptly cleaned up by personnel using the appropriate PPE. Proper disposal of contaminated materials shall be in accordance with EPD requirements and GI 430.001.

10.6.13 Personnel who handle, store, use or dispose of hazardous materials/waste shall receive hazard communication (HAZCOM) training. See GI 150.100.

10.6.14 When a contractor is required to dispose of waste determined to be hazardous, the contractor shall follow Saudi Arabian Government regulations and SA requirements in disposing of hazardous waste materials. Contractor shall provide SA with documented evidence that hazardous wastes have been properly disposed of at a licensed hazardous waste disposal facility.

10.7 Hydrogen Sulfide (H_2S)

10.7.1 Air supplied respiratory protection equipment (e.g., self-contained breathing apparatus [SCBA], air-line respirator) shall be made available to personnel who may be exposed to an H_2S release. See GI 1780.001.

10.7.2 Air supplied respiratory protection equipment shall be worn by all personnel in an area where the H_2S concentration equals or exceeds 10 parts per million (ppm).

10.7.3 Personnel shall not rely on their sense of smell to detect H_2S because higher concentrations can quickly deaden the sense of smell.

10.7.4 Personnel working in areas with H_2S shall be trained on the hazards and effects of H_2S exposure and proper use of applicable respiratory protection equipment.

10.7.5 Personnel shall not open or enter lines, vessels, tanks or equipment that contains (or has the potential to contain) H_2S without a properly prepared procedure. The procedure shall include, but not be limited to:

- Properly completed work permits (e.g., Release of Hazardous Liquids or Gases permit).
- Properly calibrated H_2S-detection equipment and personal monitors.
- Testing of the atmosphere inside the vessel/equipment prior to opening and/or entering the space per GI 2.709.
- Available standby personnel who are trained on the hazards and affects of H_2S exposure, how to use an SCBA and performing first aid/basic life support (BLS).
- Use of SCBA or air-line respirator with 5-minute escape pack by personnel entering any line, vessel or equipment with H_2S concentrations at or above 10 ppm. See Chapter I-6, *Confined Spaces*.
- Notification of personnel in the immediate area before work begins.

- Use of the "buddy system" if atmospheric testing indicates H_2S levels at or above 10 ppm.
- Observance of wind direction.
- Controls used to keep nonessential personnel upwind or crosswind from the work site location.
- Contingency plan/emergency response procedures in the event of an H_2S release or personnel exposure to elevated levels of H_2S.
- Preplanned escape route(s) and assembly areas in the event of an emergency.
- Specific methods for alerting personnel during an emergency condition.

10.7.6 Personal H_2S monitors shall be worn as required by local SAPO procedures in areas where H_2S concentrations have the potential to equal or exceed 10 ppm.

10.7.7 Personnel shall use calibrated gas monitoring equipment when performing work in areas where there is an H_2S hazard.

10.7.8 Warning signs and barricades shall be posted advising personnel of the potential presence of H_2S in the work area.

10.7.9 Personnel shall not be allowed to enter areas where the atmosphere contains an H_2S concentration of 100 ppm or greater, except in emergencies. An atmosphere containing 100 ppm of H_2S is considered immediately dangerous to life or health (IDLH).

10.7.10 Only properly trained personnel wearing an SCBA shall attempt to rescue a victim of H_2S exposure.

10.7.11 The "buddy system" is mandatory when responding to H_2S emergencies or when working in H_2S IDLH conditions. A "buddy system" involves organizing employees into work groups so that each employee in the work group is designated to be observed by at least one other employee in the work group (e.g., be within line-of-sight with each other).

10.7.12 Personnel expected to use a SCBA as part of their normal or emergency duties shall be medically approved before donning the device, per the requirements of GI 150.110.

10.7.13 H_2S Training

A. Training shall be provided to personnel working in areas where there is a potential H_2S exposure. The training shall be provided prior to being approved for work and shall be documented.

B. Training shall include, at a minimum:

- Physical and chemical properties of H_2S.
- Natural and industrial H_2S sources, including decomposition of organic matter (wastewater, sewers), waste streams of industrial operations, crude petroleum and natural gas.
- Signs and symptoms of H_2S exposure, including the physical warning properties of rotten egg odor, burning of eyes, throat irritation, nausea and dizziness.
- Responsibilities of standby personnel, including:
    - Monitoring personnel for potential effects of H_2S exposure.
    - Proper use of H_2S detection equipment.
    - Monitoring strategy (e.g., frequency of atmospheric testing).
    - Securing the work area(s).
    - Monitoring wind direction.
    - Notification of emergency assistance if required.
- PPE, especially respiratory protection:
    - Locations of SCBAs and spare cylinders.
    - Limitations and capabilities of SCBAs and air-line respirators.
    - Demonstrated proficiency in use of a SCBA.
- Emergency response procedures including:
    - Instructions for alerting personnel of an emergency.
    - Notification of emergency response organizations and personnel.
    - Evacuation routes and assembly areas.
    - Detailed site-specific emergency procedures.
- H_2S detection and monitoring methods, with instructions on the types of monitoring equipment available, including:
    - Limitations.
    - Calibrations.
    - Function testing.
    - Use.

C. Refresher training shall be provided at least every two years and be documented.

D. Visitors shall receive a site-specific orientation on local sources of H_2S, health hazards and signs of exposure to H_2S, evacuation routes and emergency assembly areas, applicable alarm signals and how to respond in an emergency.

10.8 Asbestos and Asbestos-Containing Material (ACM)

10.8.1 Work involving asbestos-containing material (ACM) shall be per GI 150.001. Work permit(s) per GI 2.100 shall be obtained for any ACM-related work.

10.8.2 Personnel performing ACM work shall be subject a medical examination per GI 150.001.

10.8.3 The work area shall be clearly defined, roped off and signs posted to warn personnel of the presence of ACM. Signs shall be posted at all approaches to the work area in readily visible locations and shall be in Arabic and English.

10.8.4 Wet methods shall be used for removing or disposing of ACM to prevent the release of asbestos fibers. ACM shall be wetted continuously while removal is in progress. If wet methods cannot be applied, the SA EPD shall be consulted for special procedures for ACM removal. For further information on ACM handling and removal practices, see GI 150.001.

10.8.5 Shearing, punching, sawing or drilling of ACM shall be performed manually. The work surface shall be wetted throughout the operation to minimize ACM dust. Cutting with power-operated tools is prohibited, unless the equipment has high-efficiency particulate air (HEPA) exhaust ventilation.

10.8.6 PPE, including respiratory protection, per GI 150.001 shall be worn wherever ACM-related work is performed, regardless of ventilation, wetting, etc.

10.8.7 Dry sweeping, shoveling or other dry cleanup methods of ACM dust and debris is prohibited.

10.8.8 Eating, drinking and smoking are prohibited in ACM work areas. Personnel shall exit and shower before eating, drinking or smoking after being in an area containing ACM.

10.8.9 At the end of a shift, personnel shall proceed first to a nearby designated area, where contaminated coveralls and equipment shall be removed, collected and disposed of, then proceed to the shower and cleanup area. Selected equipment to be reused shall be collected, cleaned, decontaminated and disinfected prior to reuse.

10.8.10 Contaminated waste, ACM and used disposable clothing shall be transported and disposed of in sealed impermeable bags or containers. Bags and containers shall be marked in both Arabic and English with: "Caution: Health Hazard - Contains Asbestos." The bags and containers shall be handled and disposed of in accordance with GI 150.001. See Figure 10.3.

Figure 10.3 Asbestos Warning Label

10.9 Naturally Occurring Radioactive Material (NORM)

10.9.1 Work involving NORM-contaminated materials shall be per SAEP-358. Work permit(s) per GI 2.100 shall be obtained for any NORM-related work.

10.9.2 Personnel working with or around NORM-contaminated piping, equipment, materials (e.g., filter cartridges), soil or wastes shall be trained in the hazards of NORM.

10.9.3 Tasks involving NORM-contaminated equipment or materials shall be covered by a job safety analysis (JSA), which shall identify the hazards and associated controls to be used.

10.9.4 Prior to performing an activity involving intrusive operations on any equipment/vessels suspected of having NORM contamination (e.g., cleaning, entering, repairing), a NORM survey shall be performed per SAEP-358.

10.9.5 Based upon the results of the NORM survey, any item or area with detectable levels of NORM contamination shall be subject to contamination control measures and personnel shall follow worker protection requirements per Section 10.9.6 and SAEP-358.

10.9.6 Personnel entering NORM-contaminated pipelines or vessels or conducting intrusive operations on NORM-contaminated equipment shall:

A. Wear appropriate personal protective equipment (PPE), which includes but is not limited to:

- Tyvek coveralls.
- Neoprene, butyl/neoprene or PVC gloves.
- Half-face respirators with HEPA cartridges.
- Quarter-face HEPA disposable respirators.

B. Not eat, drink, smoke or chew gum in areas where potential NORM contamination exists.

C. Thoroughly wash with adequate amounts of soap and water after working with or handling NORM-contaminated equipment or materials, including before eating, drinking or smoking and at the end of the work day.

10.9.7 Work involving any item or area with detectable levels of NORM contamination shall be carried out in a manner that prevents the spread of NORM contamination and minimizes the potential for workers to be exposed to NORM. NORM operations shall only be undertaken in areas that are clearly marked and barricaded, with access restricted to those directly involved in the operations.

10.9.8 Transport of NORM-contaminated equipment or materials shall be per SAEP-358.

10.9.9 Any NORM-contaminated equipment or materials that require release or disposal shall be handled, transported and disposed of in accordance with SAEP-358 and GI 430.001.

10.10 Mercury-Contaminated Material

10.10.1 Equipment, vessels or pipelines in facilities that process hydrocarbons with elevated levels of mercury have the potential to accumulate either free mercury or "black powder" and sludge rich with mercury. Therefore, operations involving crude oil, gas condensate and natural gas (e.g., "black powder" at scraper traps) may contain mercury-contaminated material.

10.10.2 Prior to handling or disposal of "black powder" or sludge, samples shall be analyzed using internationally accepted methods, such as the toxicity characteristic leaching procedure (TCLP) for heavy metals in sludge/solid hazardous wastes.

10.10.3 The SAPO shall notify the SA EPD two weeks prior to working on any equipment that is potentially contaminated with mercury.

10.10.4 SA EPD shall be provided with an up-to-date list of all personnel involved in work with equipment that is potentially contaminated with mercury.

10.10.5 Work permit(s) per GI 2.100 shall be obtained for any mercury-related work. Entry into any vessels or pipelines that potentially contain mercury-contaminated material shall be in accordance with Chapter I-6, *Confined Spaces*, of this manual.

10.10.6 Personnel entering mercury-contaminated vessels or pipelines, conducting intrusive work on mercury-contaminated equipment or conducting activities that may release mercury into the ambient air (e.g., welding of contaminated piping) shall be trained in the hazards associated with mercury.

10.10.7 The work area shall be barricaded with posted warning signs that clearly warn personnel of mercury hazards. Warning signs shall be in both Arabic and English. The warning sign shall read:

WARNING
MERCURY HEALTH HAZARD
AUTHORIZED PERSONNEL ONLY

10.10.8 Tasks involving mercury-contaminated equipment or materials shall be covered by a job safety analysis (JSA) which shall identify the hazards and associated controls to be used.

10.10.9 All personnel in the immediate area shall be notified before work begins. Nonessential personnel shall be kept upwind or crosswind from the work site location.

10.10.10 Exposures to levels exceeding the American Conference of Governmental Industrial Hygienists (ACGIH) mercury TLV of 0.025 mg/m^3 shall not be permitted without proper PPE, including respiratory protection. It is important to note that the TLV has a skin notation indicating that mercury can be readily absorbed through the skin.

10.10.11 Mercury-contaminated equipment, vessels or pipelines shall be continuously mechanically ventilated during confined space entry operations. The exhaust of the air blower shall be located downwind. Ventilation must be sufficient to ensure that mercury vapor does not exceed the mercury TLV.

10.10.12 Measurements of mercury vapor shall be conducted at representative locations inside equipment, vessels and pipelines throughout the work. Samples shall be collected by SA EPD Industrial Hygienists. Results of the air testing shall be used to determine changes in the level of required PPE, including respiratory protection.

10.10.13 Personnel entering equipment, vessels or pipelines shall wear air-supplied respirators or SCBAs, unless otherwise instructed by the SA EPD. See Chapter I-3, *Personal Protective Equipment*, for information regarding respiratory protection equipment.

10.10.14 Personnel working with mercury-contaminated equipment or materials shall wear appropriate PPE, which shall include, but not be limited to:

A. Disposable DuPont™ Tychem® SL coveralls or equivalent, following prior approval from the SA EPD. Coveralls shall be fitted with elastic hoods. Street clothing and/or work overalls shall not be worn under disposable coveralls.

B. Neoprene or butyl/neoprene gloves.

C. Chemical resistant overboots.

10.10.15 Decisions on downgrading/upgrading any level of PPE rests with SA EPD and shall be based, as a minimum, on current work activities, airborne levels of mercury contamination detected and visual determination of mercury contamination. Any proposed changes to the required level of PPE used by personnel shall be approved in writing by the SA EPD.

10.10.16 Personal ("street") clothing shall never be worn inside mercury-contaminated equipment or pipelines, including under coveralls.

10.10.17 A personal decontamination station consisting of a clean change room, a contaminated room and a cleanup room shall be provided for workers, as follows:

A. The clean change room shall be equipped with personal lockers for the storage of personal ("street") clothing and personal belongings (NOTE: jewelry, particularly gold, is strictly prohibited inside any mercury-contaminated area).

B. The contaminated room shall be equipped with sealable receptacles (e.g., plastic drums) for disposal of coveralls, spent respirator filters, gloves, overboots, etc. At the end of each shift, workers shall proceed to the contaminated room where contaminated coveralls and equipment shall be removed, collected and disposed of.

C. Selected equipment slated for reuse (e.g., respirators) shall be collected in a separate container and cleaned, decontaminated and disinfected as necessary prior to reuse.

D. The cleanup room shall be equipped with hand wash station(s), liquid soap and disposable towels. Prior to proceeding to the clean room and changing to personal clothing, workers shall thoroughly wash hands, face and any other body parts that may have been accidentally exposed during work activities.

10.10.18 Any mercury-contaminated equipment or materials that require release or disposal shall be handled, transported and disposed of in accordance with GI 430.001.

11. Hand Tools and Power Tools

11.1 Purpose

This chapter describes minimum safety requirements for selection, use and care of hand tools and power tools, both portable and fixed.

11.2 References

Saudi Aramco (SA) General Instructions (GIs)

GI 2.100, *Work Permit System*

GI 8.002, *Safety Spectacles*

GI 8.005, *Protective (Safety) Footwear*

U.S. Code of Federal Regulations (CFR):

29 CFR 1910, Subpart O, *Machinery and Machine Guarding*

29 CFR 1910, Subpart P, *Hand and Portable Powered Tools and Other Hand-Held Equipment*

29 CFR 1926, Subpart I, *Tools - Hand and Power*

American National Standards Institute (ANSI):

ANSI/ASSE A10.3, *Safety Requirements for Powder-Actuated Fastening Systems*

ANSI B7.1, *Safety Code for the Use, Care, and Protection of Abrasive Wheels*

National Fire Protection Association (NFPA):

NFPA 70, *National Electrical Code* (NEC)

11.3 General Requirements

11.3.1 Required work permits when using hand tools and power tools shall be obtained in accordance with GI 2.100.

11.3.2 Appropriate personal protective equipment (PPE) shall be worn at all times when using hand tools and power tools (e.g., hard hat, safety glasses/ goggles, hearing protection, safety shoes, gloves, face shield). See Chapter I-3, *Personal Protective Equipment (PPE),* of this manual.

11.3.3 Personnel shall not operate any tools unless they are appropriately trained in their selection, use, inspection and storage. Training records shall be made available upon request.

11.3.4 Tools constructed of good quality materials shall be used. Use of "homemade" tools is prohibited.

11.3.5 Tools shall be kept clean at all times.

11.3.6 Tools shall be inspected before and after use, as well as before storage.

11.3.7 Excessively worn, defective or deformed tools shall not be used. If excessive wear, defect or damage is observed, the tool shall be immediately tagged and withdrawn from use for repair or disposal.

11.3.8 Proper racks and boxes shall be provided and used for storage of tools.

11.3.9 The correct type, size and weight of tool shall be used for each task.

11.3.10 Only properly insulated or nonconductive tools shall be used when work is performed on or near electrical equipment. Insulation integrity shall be regularly inspected by an authorized/certified electrician. See Chapter III-3, *Electrical Equipment*.

11.3.11 A record of tools issued, repaired or withdrawn from use shall be maintained.

11.4 Requirements for Specific Types of Hand Tools

11.4.1 Screwdrivers

A. Tips shall be the correct size to fit the slot of the screw.

B. Pliers or other tools shall not be used to obtain additional leverage on the screwdriver's shank.

C. Handles shall not be subjected to blows from hammers or similar instruments.

D. Handles shall be insulated when used for electrical work.

11.4.2 Pliers

A. Pliers shall not be used as wrenches.

B. Pliers shall have insulated handles when used for electrical work.

C. Pliers shall be kept free from dirt and grit.

11.4.3 Hammers

A. The correct type and size shall be used for the task.

B. Handles shall be made from smooth timber, bonded fiberglass or be made of an integral head and shaft of steel.

C. Proper wedges shall be used to secure heads to wooden handles.

11.4.4 Chisels

A. Cutting edges shall be kept sharp at all times, and the original shape and angle shall be maintained.

B. Mushroomed heads shall be ground with a slight taper around the edge to prevent chipping and reduce the tendency to mushroom again.

C. Tools made of brass or aluminum, such as hammers and chisels, shall only be ground using silicon carbide grinding wheels.

11.4.5 Hacksaws

A. Blades shall be suitable for the material to be cut.

B. Sufficient tension shall be applied to maintain a rigid blade.

C. Hacksaw blade teeth shall be pointed in the forward direction (away from the user's body).

11.4.6 Hand Saws

A. The teeth shall be kept sharp and clean. Blades shall be lightly oiled or greased when not in use to prevent corrosion (e.g., while in storage).

B. Blades shall be protected by a slotted piece of timber or a sheath when not in use.

C. Cracked, defective or damaged saws shall not be used.

11.4.7 Spanners and Wrenches

A. The correct size spanner or wrench shall be used.

B. When possible, use a box-end or open-end wrench rather than an adjustable wrench.

C. The use of "cheater bar" extensions is prohibited.

D. Only wrenches specifically designed to be struck by hammers shall be used for that purpose.

E. Properly designed hammer/slugging wrenches shall be used for heavy work.

11.4.8 Pipe Wrenches

A. Pipe wrenches shall be large enough for the work to be performed. Jaw teeth shall be kept clean and sharp, and the knurl, pin, spring, etc., kept free from damage.

B. The use of “cheater bar” extensions is prohibited.

C. Pipe wrenches shall not be struck with a hammer or used as a hammer.

11.4.9 Hand Excavation Tools

A. Hand excavation tools (e.g., picks and shovels) shall be maintained in good condition at all times.

B. Blades shall not be blunt, turned, split or jagged.

C. Pick and shovel shafts shall be free of cracks, splinters and other defects or damage.

D. Pick shafts shall be firmly attached to the head.

11.4.10 Hydraulic Jacks

A. Jacks shall be clearly marked with their rated load capacity. The rated load capacity shall be legibly and permanently marked in a prominent location on the jack by casting, stamping or other suitable means.

B. The load to be lifted shall be less than the jack’s rated load capacity.

C. Jacks shall be placed on a level, solid support with the load centered.

D. Once raised, the load shall be immediately and properly blocked/secured.

E. Jacks shall not be used when there is evidence of a hydraulic oil leak.

F. The jack release mechanism shall be clearly marked and shall not be located where it can be accidentally operated.

G. Jacks shall be properly lubricated at regular intervals.

H. Jacks shall be thoroughly inspected at least every 6 months. Jacks shall be visually inspected when issued and when returned to the tool room/crib.

I. A jack subjected to abnormal load or shock shall be immediately inspected

J. Damaged/defective jacks shall be immediately removed from service.

11.5 Portable Power Tools – General Requirements

11.5.1 Portable power tools shall be equipped with properly functioning constant pressure switches or controls that will shut off the power when the pressure is released (i.e., a “dead man” switch).

11.5.2 Power tools shall not be equipped with trigger locks.

11.5.3 Protective shields/guards supplied with the tools (per design) shall not be removed.

11.5.4 The operating control on hand-held power tools shall be located to minimize the possibility of inadvertent operation.

11.5.5 Before they are set down, rotating portable power tools shall be switched off and held until the rotation has completely stopped. They shall not be stopped by grasping the rotating assembly.

11.5.6 Power tools shall be disconnected from the power source before changing bits, blades, cutters or wheels.

11.5.7 Portable power tools shall be stored in clean and dry conditions.

11.5.8 Portable power tools shall not be left lying around the work area where they could be damaged.

11.5.9 Cords, cables, etc., shall be positioned where they are not likely to be damaged (e.g., run overhead) or shall be otherwise protected from damage (e.g., running them inside impact resistant conduit or using abrasion resistant supply leads).

11.5.10 Use of the electrical cord for hoisting or lowering power tools is prohibited.

11.6 Portable Pneumatic Power Tools

11.6.1 Portable air compressors shall be per Chapter III-2, *Mechanical and Heavy Equipment*.

11.6.2 Compressed air hoses shall be the correct size and rating for the tool being used.

11.6.3 Compressed air hose joints (twist lock fittings) shall be secured with proper couplers and safety wires/pins and/or whip checks to prevent the tool and hose couplings from being inadvertently disconnected.

11.6.4 Crimped, clamped or banded connections (see photo) shall be used to secure compressed air hoses to fittings/couplers.

11.6.5 Screw-type ("Jubilee") hose clamps (see photo) shall not be used to secure compressed air hoses to fittings/couplers.

11.6.6 Hose lengths shall be kept as short as possible and placed so they are not subject to damage (e.g., not crossing active roadways or walkways).

11.6.7 Compressed air used for cleaning formwork, etc., shall be less than 30 psig.

11.6.8 Compressed air systems operating at or above 30 psig nozzle pressure shall have a relief device and/or air ports (see Figure 11.1) installed on the nozzle that limit the nozzle pressure to less than 30 psig if the air system becomes dead ended (e.g., inadvertently pressed against an object or person).

Figure 11.1 Air Nozzle with Relief Air Ports

11.6.9 Compressed air shall not be used to remove dust or dirt from clothing or individuals. Compressed air hoses shall not be directed towards an individual for any reason.

11.6.10 Abrasive blasting shall be per Chapter II-8, *Abrasive Blasting*.

11.6.11 Jackhammers (Pneumatic Drills)

A. Tool bits for jackhammers or concrete breakers shall be securely positioned to prevent the bit from being ejected during operation. The bit shall be kept sharp.

B. Ear, eye, hand (thick gloves to minimize vibration) and foot protection (e.g., safety shoes with metatarsal guards) shall be worn by all personnel working with or near jackhammers and concrete breakers. See Chapter I-3, *Personal Protective Equipment (PPE)*.

11.7 Portable Electric Power Tools and Extension Cords

11.7.1 Portable electric power tools shall be rated for use at a voltage not exceeding 240 V.

11.7.2 Power sources and portable electric power tools shall be of a single voltage (110 V or 220 V nominal) within a single job site or operating area. Portable electric power tools shall match the supplied power source voltage.

11.7.3 Portable electric power tools shall be certified by an independent testing and certification service such as Underwriters' Laboratories (UL), Factory Mutual (FM) or KEMA-KEUR (or equivalent* as specified in writing by the SA Loss Prevention Department) and shall bear the appropriate certifying agency mark. See Figure 11.2.

* Note: CE marking is not equivalent to an independent certification by a recognized body. CE marking (Conformité Europeéne) indicates only the manufacturer's declaration of conforming to the legal requirements to achieve CE marking.

Figure 11.2 Example Certification Marks

11.7.4 Portable electric power tools shall not be altered from their original manufactured state. Power tools are certified by an independent testing and certification service as a complete unit; alteration is prohibited.

11.7.5 Portable electric power tools shall be double insulated or properly grounded with a manufacturer installed three-prong plug.

11.7.6 Plug adaptors are prohibited. Portable electric power tool plugs shall match the power source outlet.

11.7.7 Portable electric power tools and extension cords shall be protected by an overcurrent protection device (e.g., panel mounted circuit breaker or in-line fuse).

11.7.8 Residual current devices (RCDs), including ground fault circuit breakers (GFCIs) and earth leak current breakers (ELCBs), shall be used for all 110/220 V portable electric power tools.

11.7.9 RCDs shall have a maximum rated tripping current of 10 mA.

11.7.10 RCDs should be installed as close to the power source as practicable (e.g., at distribution board/panel).

11.7.11 RCDs shall be installed in enclosures to protect against environmental conditions and designed for use in outdoor environments. RCDs shall be protected against mechanical damage and vibration.

11.7.12 Users of portable electric power tools shall visually inspect and check the function of the RCD by operating the "test" button daily.

11.7.13 RCDs shall be tested every three months by a competent person using appropriate electrical test equipment (i.e., an RCD tester that simulates a ground/earth fault current to trip the device under test).

11.7.14 Any portable electric power tool or extension cord used in a SA restricted area requires a hot work permit per GI 2.100.

11.7.15 Electrical extension cords shall:

A. Be as short as possible.

B. Have appropriate grounding pins and blades to fit the socket outlet.

C. Be of three-wire conductor type.

D. Be #12 gauge (AWG) minimum if less than 30 m (100 ft) long and #10 gauge minimum if 30 m (100 ft) long or longer.

E. Be rated for outdoor use (i.e., have a "W" designation for the insulation/jacket).

F. Repaired by a certified electrician and be spliced so that the splice retains the insulation, outer sheath properties and usage characteristics of the cord being spliced (e.g., use a manufactured splice kit).

F. Not be connected together in sequence (i.e., connected in a daisy-chain layout).

G. Not be used for permanent wiring.

H. Be certified by an independent testing and certification service such as UL, FM or KEMA-KEUR (or equivalent as specified in writing by the SA Loss Prevention Department) and shall bear the appropriate certifying agency mark.

11.7.16 Job-made extension cords shall be fabricated by a certified electrician and shall meet the requirements in Sections 11.7.15(A) through 11.7.15(H). In addition, flexible cables used to make job made extension cords shall be rated for junior hard or hard service usage per NFPA 70 (Article 400) and shall be indelibly marked as such approximately every 0.3 m (1 ft) along the length of the cord (e.g., marked SJ, SJO, SJT, SJTO for junior hard service or S, ST, SO, STO for hard service). Job-made extension cords shall be fitted with receptacle boxes and plugs labeled as meeting "NEMA Type 4," "NEMA Type 4X," "IEC IP 55" or higher.

11.7.17 Portable lights shall:

A. Be equipped with insulated handles, have substantial guards attached to the handle or holder, and not have paper-lined metal shell/guard if the light is powered by alternating current (AC).

B. Be certified by an independent testing and certification service such as UL, FM or KEMA-KEUR (or equivalent as specified in writing by the SA Loss Prevention Department) and shall bear the appropriate certifying agency mark.

C. Be properly grounded with a manufacturer installed three-prong electrical plug is the light is powered by AC.

D. Not be used in a SA restricted area without a hot work permit per GI 2.100, except explosion-proof flashlights.

E. Be repaired or replaced if defective.

F. Be inspected prior to issuing/using. Frequent random on-site checks shall be performed.

G. Not be placed where heat generated by the light could ignite combustible materials (e.g., scaffold planks).

11.7.18 Flashlights ("torches") shall be explosion-proof (e.g., labeled "Ex" or "UL 844") if used within a SA electrically classified area.

11.7.19 Portable Drills

A. Large holes shall be drilled in stages with step drills or by using smaller bore drill bits and gradually increasing the drill bit size.

B. Drills shall not be equipped with a trigger lock.

C. Drill bits shall be kept sharp and clean.

11.7.20 Portable Saws

A. Hand-operated circular saws (e.g., Skilsaws) shall be fitted with a retractable spring-loaded guard that allows only the working part of the blade to be exposed. See Figure 11.4.

B. Portable table saws shall be provided with adjustable guards, anti-kickback devices, push-type start/stop buttons within easy reach of the operator, and be secured against movement. See Figures 11.5 and 11.6.

C. Portable power driven circular saws having a blade diameter greater than 50 mm (2 inches) shall be equipped with guards above and below the base plate or shoe.

D. Portable saws shall be unplugged from their power source for repair, maintenance and when not in use.

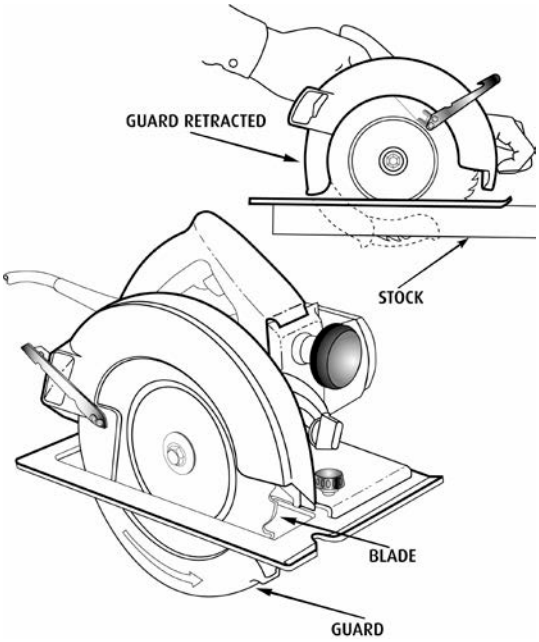


Figure 11.4 Retractable Saw Guard

Source: U.S. Occupational Safety and Health Administration

Figure 11.5 Portable Table Saw

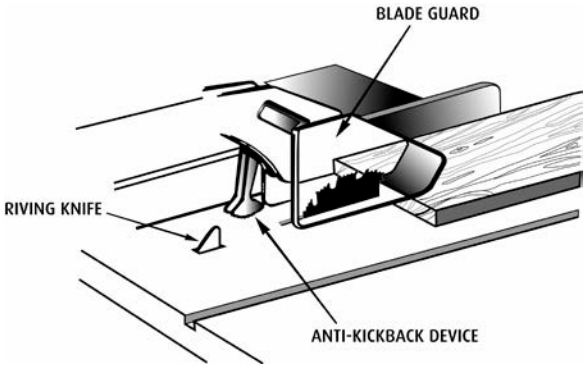


Figure 11.6 Table Saw Blade Guard

11.7.21 Masonry Saws

A. Masonry saws shall be guarded by a semicircular enclosure over the blade. The maximum angular exposure of the blade periphery shall not exceed 180 degrees. The guard design shall be able to retain fragments of the blade in case it shatters while in use.

B. Blade speed shall be maintained in accordance with the manufacturer's specifications.

C. Dry-cutting masonry saws shall be equipped with dust collectors. Operators of such saws and other persons in the area shall be provided with approved dust respirators.

D. Masonry saw operators shall wear proper hearing protection, safety glasses/goggles and a face shield. See Chapter I-3, *Personal Protective Equipment (PPE)*.

E. Masonry saws shall be inspected by a qualified person at regular intervals and be maintained in a safe operating condition.

11.8 Grinding Tools – General Requirements

11.8.1 Grinding wheels shall be free of defects. They shall be checked for defects before mounting and defective wheels shall be discarded or destroyed.

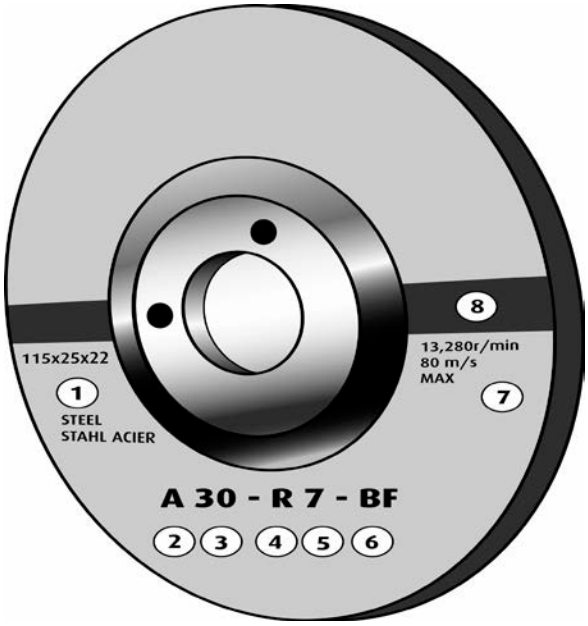
11.8.2 Grinding wheels shall be balanced and centered and shall be installed per the wheel manufacturer's instructions.

11.8.3 Grinding tools shall be inspected prior to use and shall be replaced immediately if found to be defective. Electrical wiring and other associated parts shall also be inspected.

11.8.4 Grinding tools shall not be used on soft metals (e.g., aluminum, brass, copper, lead, zinc) unless the grinding wheel is specifically designed for such metals.

11.8.5 Grinding tools shall not be used unless the maximum permissible speed is clearly marked on the wheel and case. See Figure 11.7.

11.8.6 The running speed shall not exceed the maximum permissible speed displayed on the grinding wheel.



1. Dimensions	5. Structure
2. Nature of the Abrasive	6. Bond Type
3. Abrasive Grain Size	7. Maximum Speed
4. Grain Grade (Hardness)	8. Color Stripe = Speed

Figure 11.7 Abrasive/Grinding Wheel Markings

11.8.7 Safety guards provided the manufacturer for grinding wheels shall be used and maintained at all times. Guards shall allow only the working part of the wheel to be exposed. The guard shall also cover the spindle end, nut and flange projections. The maximum angular exposure of the grinding wheel perimeter and sides shall not exceed 180 degrees.

11.8.8 Safety guards shall be mounted to maintain proper alignment with the wheel. The guard and fastenings shall be strong enough to retain fragments of the wheel in case of accidental breakage.

11.8.9 Portable grinders may only be used without safety guards when the work location makes it impossible to use a grinder equipped with a safety guard (e.g., internal grinding inside a small diameter pipe). In this case, the employee's supervisor shall approve such use, the second handle shall be

on the grinder and used, and the guard shall be immediately replaced afterwards.

11.9 Fixed Electric Tools

11.9.1 Fixed or permanently mounted electric tools shall be hardwired to the power supply and may be powered by a 220 volt electrical supply if a 110 volt tool is not available.

11.9.2 Fixed Grinding Equipment

A. Floor and bench-mounted abrasive wheels shall be provided with safety guards (e.g., protection hoods). Safety guards shall be capable of withstanding the effect of a bursting wheel.

B. Grinding wheels shall be balanced and centered and shall be installed per the wheel manufacturer's instructions.

C. The maximum angular exposure of the grinding wheel periphery and sides shall not be more than 90 degrees, except when work requires contact with the wheel below the horizontal plane of the spindle, and then the angular exposure shall not exceed 125 degrees. In either case, the exposure shall not exceed 65 degrees above the horizontal plane of the spindle. See Figure 11.8.

D. Floor and bench-mounted grinders shall be provided with work rests that are rigidly supported and adjustable. See Figures 11.8 and 11.9. Work rests shall not exceed 3 mm (1/8 inch) from the surface of the wheel.

E. Tongue guards shall be kept adjusted to the wheel with a maximum gap of 6 mm (1/4 inch) from the surface of the wheel. See Figure 11.8.

F. Abrasive grinding wheels for fixed grinders shall be inspected and ring-tested before mounting. See Figure 11.10.

G. Grinding wheels shall not be forced on the spindle. They shall slide on easily. The spindle nut shall not be over tightened. See Figure 11.11.

H. Materials shall not be forced or jammed into the grinding wheel.

I. The sides of the abrasive wheel shall not be used as a grinding surface.

J. A grooved or damaged grinding wheel shall be immediately dressed or replaced.

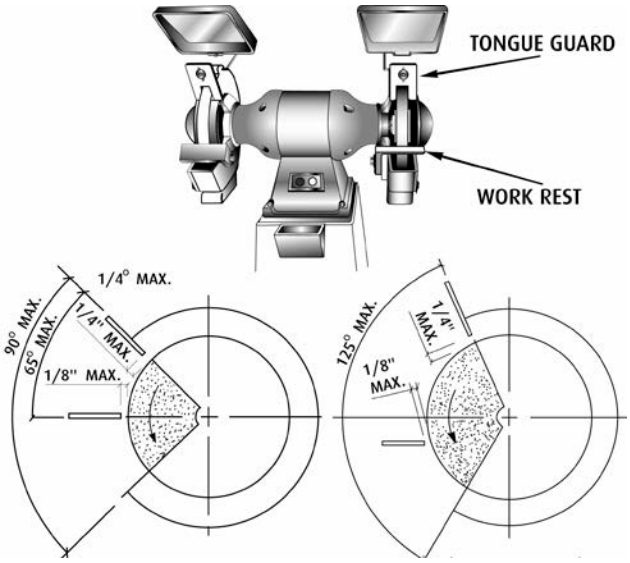


Figure 11.8 Grinder Guards

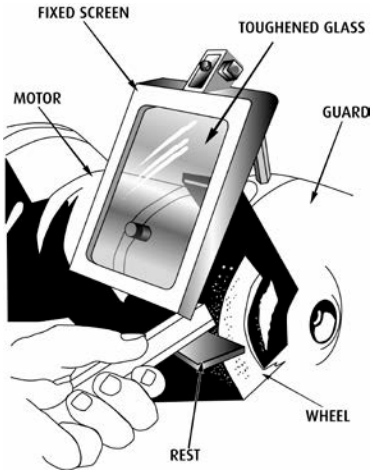


Figure 11.9 Bench Grinder Guard

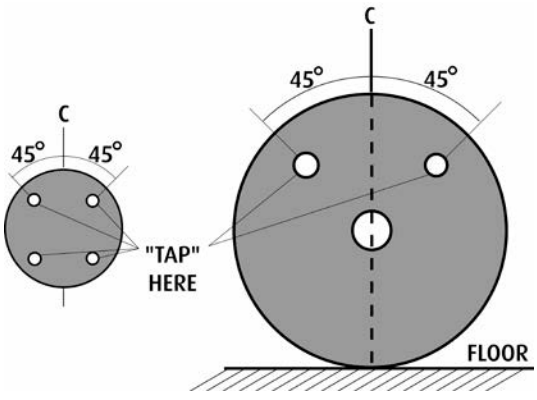


Figure 11.10 Ring Test

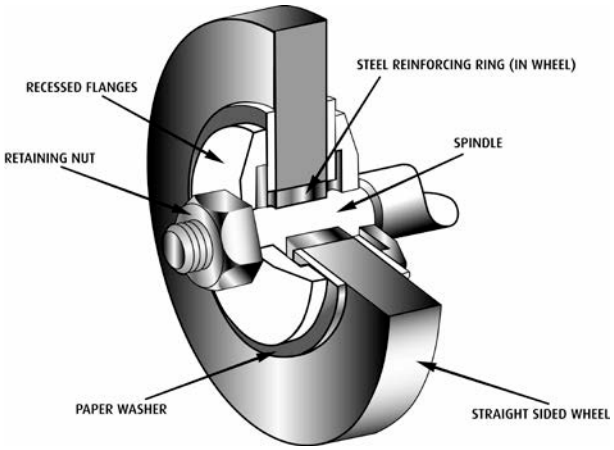


Figure 11.11 Correctly Mounted Grinding Wheel

11.9.3 Fixed Table Saws

A. Fixed table saws shall be permanently wired to an emergency electrical disconnect switch that has the capability of being locked. The start/stop buttons shall be at the operator's location.

B. Table saws shall have blade guards that cover the saw at all times. See Figure 11.6.

C. Table saws used for ripping shall have anti-kickback devices and riving knife (kerf spreader).

D. Exposed parts of the saw located underneath the table shall be guarded.

E. Table saws shall be secured in place.

F. Table saw riving knives shall be kept clean and properly adjusted to the work at all times.

G. Sufficient working space shall be provided around the saw.

H. "Push sticks" shall be available and used during the last 30 cm (12 inches) of any cut.

I. The work area shall be kept clean, including preventing excessive buildup of sawdust and scrap wood.

11.9.4 Radial saws shall be provided with:

A. An upper hood to enclose the top portion of the blade down to a point that includes the end of the saw arbor, with the sides of the lower, exposed portion of the blade guarded to the full diameter of the blade by a device that automatically adjusts to the thickness of the stock being cut.

B. Anti-kickback devices shall be on both sides of the saw and shall be designed to provide adequate holding power for all thicknesses of material being cut.

C. An adjustable stop limiting the forward travel of the blade beyond the distance necessary to complete the cut in repetitive operations.

D. A saw housing that automatically returns to the starting position.

E. A hood marked to show the direction of the saw rotation.

F. A permanent label affixed to the rear of the guard, stating: "DANGER. DO NOT RIP FROM THIS END."

G. Rigid, secure mounting.

H. Start/stop buttons at the operator's position.

I. Permanent wiring to an emergency electrical disconnect switch that is capable of being locked.

11.9.5 Chop saws/power miter saws shall be provided with:

A. A spring-loaded upper hood that encloses the entire blade when it is in the up position.

B. A locking clamp to secure the work piece from moving.

C. A spring-loaded, finger-operated start button that automatically stops the saw when the trigger is released.

11.10 Powder Actuated Fastening Tools

11.10.1 Use of powder actuated fastening tools (cartridge operated tools) shall be in accordance with ANSI A10.3 and the tool manufacturer's instructions.

11.10.2 The correct size (caliber) and strength of cartridge required for the tool, the fixing and the material to be fixed onto shall be properly determined and used.

11.10.3 The following precautions shall be followed when using powder actuated fastening tools:

A. When the tool is removed from the carrying case, it shall be checked to ensure that a cartridge is NOT LOADED.

B. Tools that are not in proper working condition shall be immediately removed from service and not used until properly repaired.

C. Tools shall not be loaded with a cartridge until just prior to the intended firing. The following safety precautions shall apply when loading a cartridge:

- The operator shall point the tool away from himself and other personnel.
- The tool shall only be loaded in the area where work is to be performed.
- The tool shall never be left loaded when not in use. Loaded tools shall not be left unattended.

D. Tools shall be checked to ensure they are NOT LOADED with a cartridge before repair/maintenance/storage.

E. The tool barrel shall be pressed hard against the fixing surface during use.

F. Tools shall be used with the correct shield, guard or attachment as recommended by the manufacturer.

G. Fasteners shall not be driven into very hard or brittle materials including, but not limited to, cast iron, glazed tile, surface-hardened steel, glass blocks, hollow tile, terra cotta, marble, granite, slate.

H. Driving into soft materials shall be avoided, unless materials are backed by another material that will prevent the fastener from passing completely through. Careful inspection of all materials shall be performed before using the cartridge tool.

I. Fasteners shall not be driven into a spalled area caused by an unsatisfactory shot or into any existing hole in the material. The new fixing shall be at least 50 mm (2 inches) away from any previous hole or any welded joint.

J. Fasteners shall not be fired into corner bricks or mortar joints. Pins shall be at least 100 mm (4 inches) away from the edge of concrete or brick work and 12 mm (½ inch) from the edge of steel.

K. Tools shall be held at a right angle (perpendicular) to the job when firing.

L. Tools shall be retriggered without moving the tool from the work face in the event of a misfire. If the shot fails again, the tool shall be held firmly in the firing position for at least 30 seconds in case of a possible “hang fire” in the cartridge. The misfired cartridge shall be removed per the manufacturer's instructions. Nails, knives, etc., shall not be used to pry the cartridge loose.

M. Tools shall be cleaned and completely assembled after use. Cartridges shall be placed in their correct color-coded box before being returned to the storage area.

N. Personnel shall not operate, clean, maintain or repair any cartridge tool without possessing a certificate of competency, issued by an accredited tool vendor or manufacturer's representative. Certificates shall identify the particular model that personnel are qualified to handle.

11.10.4 Storage

A. Storage of tools and cartridges shall be in a fireproof, dry, lockable, easily accessible and secure location.

B. Tools and cartridges shall not be stored together. Storage providing positive physical separation of tools and cartridges (e.g., a wall) shall be used.

C. Warning signs shall be posted where cartridges are stored: "DANGER - NO SMOKING - CARTRIDGE STORAGE."

D. Tool and cartridge storage areas shall be ventilated. Cartons of cartridges shall not be stacked against a wall. Ventilation spaces shall be left around the cartons.

E. Only one carton of each power-level cartridge shall be open at a time. All empty cartons and intermediate packing shall be discarded immediately.

F. Tools shall be stored in their carrying cases. No loose cartridges shall be in the carrying case; all cartridges shall be in their color-coded boxes.

G. Only authorized personnel shall be allowed access to the storage area.

H. Storemen shall be trained and certified if they are required to clean and maintain powder actuated fastening tools. Training documentation shall be maintained in the personnel files.

11.10.5 Issue and Returns

A. A system for issuing and returning powder actuated fastening tools and cartridges, with signatures, shall be used. A usage log of tools by serial number shall be maintained.

B. Tools or cartridges shall only be withdrawn from the storage area by authorized personnel possessing a valid user certificate.

C. Only the minimum number of cartridges required for that particular shift's operation shall be issued.

D. Powder actuated fastening tools and cartridges shall not be left at the job site during a lunch break or at the end of a shift, but shall be returned to the storage area for safekeeping.

E. Loss of a powder actuated fastening tool and/or cartridges shall be immediately reported to the SA proponent organization.

12. Materials Handling

12.1 Purpose

This chapter describes minimum requirements for the movement, storage and handling of materials used in Saudi Aramco (SA) facilities and construction sites.

12.2 References

SA General Instructions (GIs):

GI 1010.007, *Safe Practices for Towing Equipment and Trailers*

GI 1183.005, *Procedure for Requesting Cargo Hauling, SAP Transaction ZTCV431A, Truck Request*

SA Engineering Procedures (SAEPs):

SAEP 35, *Valves Handling, Hauling, Receipt Tests and Storage*

SAEP 361, *Storage, Handling and Installation of Weight-Coated Pipe*

SA Safety Handbook, *Minimum Safety Rules*

12.3 Planning

12.3.1 Selection of a storage area for materials shall be made with due consideration for drainage and protection from rain and sandstorms.

12.3.2 No material or equipment shall be stored under energized electrical buses or power lines, or near energized equipment.

12.3.3 Storage areas shall be planned to minimize the reversing and maneuvering of vehicles, especially into and out of congested/tight areas.

12.3.4 Access ways shall be wide enough to allow passage of emergency response equipment.

12.3.5 Adequate firefighting equipment shall be readily available and accessible in storage areas. See Chapter I-7, *Fire Prevention*, of this manual for further requirements concerning storage areas.

12.3.6 Cribbing timber, racks or pallets shall be used to ensure that materials are stored off the ground.

12.3.7 Protection shall be provided for materials that could be damaged by moisture, such as cement, insulation and other bulk material.

12.3.8 All machinery, equipment and valves shall be maintained fully assembled and securely closed. All machined surfaces shall be covered and fully protected from exposure to the weather.

12.3.9 The quantity of material on-site at any one time shall be restricted to a minimum stock. Flammable stores shall be kept separated.

12.3.10 When necessary, appoint a materials controller who is responsible for materials during planning, unloading, storage and final distribution.

12.4 Machine Transport

12.4.1 Truck Request

Requests of a vehicle for the movement of general cargo, liquids, explosives and special equipment moves shall comply with GI 1183.005.

12.4.2 Dumpers

A. Dumper drivers shall be properly trained and experienced and shall hold a current Saudi Arabian Government license.

B. Passengers shall not be allowed to travel in the skip or anywhere else on the dumper.

C. Dumpers shall be regularly maintained with particular attention to brakes, steering and the skip release mechanism. If they are to be used for towing, a proper towing eye with a shackle or pin shall be provided.

12.4.3 Tractors and Trailers

A. The methods, procedures and responsibilities for towing equipment and trailers shall comply with GI 1010.007.

B. Safety chains or wire ropes shall be attached between the towing vehicle and trailer to allow the towing vehicle to bring the trailer to a controlled stop if the towing connection breaks or becomes separated. Tractor trailers using a fifth wheel connection do not require such safety chains or wire ropes.

C. The trailer and its load shall not exceed the rated capacity of the trailer or the towing capacity of the tow vehicle. The trailer shall be fitted with an independent braking system if it is designed to carry more than 9,100 kg (20,000 lb).

D. Pipe-carrying trailers shall be fitted with side stops. Trucks transporting pipes shall be fitted with a metal partition/barrier on the front end of the trailer or truck/tractor to prevent the material being transported from striking the cab in case of a sudden stop or travel down a steep grade.

E. Loads shall be securely tied down before being moved. The load shall be covered if it includes loose material (e.g., dirt, sand, gravel).

F. Warning placards, such as "Wide Load", shall be properly affixed when a wide (or large) load is being transported.

G. Applicable road permits shall be obtained prior to transportation of wide, over-height or over-weight loads. The transportation of such loads shall comply with applicable Saudi Arab Government laws and SA requirements (e.g., movement may be restricted due to heavy traffic or prohibited from traveling during night time). The route shall be preplanned to check for adequate clearances, weight restrictions, etc. An escort vehicle is required when transporting wide, over-height or over-weight loads within a SA facility.

H. If any part of the load extends from the trailer (at either side or end), the edges shall be clearly marked with red and white warning tape. For piping, a red flag/cloth or flashing light shall be affixed at the end of the pipe.

12.4.4 Conveyor Belts and Monorails

A. All pulleys, rollers, gears and pinch points shall be guarded.

B. Conveyor systems shall be equipped with audible warning signals to sound immediately before the conveyor starts.

C. On/off switches shall be clearly marked and readily accessible at the operator's station. Emergency stop pull cords shall be provided along both sides of a belt conveyor system.

D. Emergency stop switches shall be configured so the conveyor cannot be started again until the actuating stop switch has been reset to the running or "on" position.

E. Loose clothing, long hair, etc., shall not be allowed when working on or near conveyor systems.

12.5 Site Storage

12.5.1 The issuing and receiving of material for on-site storage shall be under the control of a responsible person (e.g., materials controller, unit foreman).

12.5.2 Adequate firefighting equipment shall be readily available and accessible in the storage area.

12.5.3 See Chapter I-7, *Fire Prevention*, for fire prevention requirements for storage areas.

12.5.4 All materials stored in tiers shall be stacked, racked, blocked, interlocked or otherwise secured to prevent sliding, falling or collapse.

12.5.5 Lumber shall be stacked such that it is stable and self-supporting and shall be on level and solidly supported sills. Piles shall not exceed 4.8 m (16 ft) in height if the lumber is handled manually or 6.0 m (20 ft) when handled with equipment. Used lumber shall have all nails removed before stacking.

12.5.6 Structural steel, poles, pipe, bar stock and other cylindrical materials, unless racked, shall be stacked and blocked so as to prevent spreading or tilting.

12.5.7 Material shall be stored on shelving rated for the load. Small items (e.g., nuts and bolts) shall be stored in bins suitably marked with their contents.

12.5.8 The safe loads allowed on racks and maximum stack heights shall be established and posted.

12.5.9 Materials on racks/shelves shall not be stacked to a height that disrupts existing fire protection sprinkler system capabilities (e.g., impedes the footprint of a sprinkler head).

12.5.10 In storage areas on elevated floors, the maximum safe load limit, in kg/m^2 and lb/ft^2, shall be conspicuously posted. Maximum safe loads shall not be exceeded.

12.5.11 Storage areas and walkways shall be maintained free of dangerous depressions, obstructions and debris.

12.5.12 Aisles and passageways shall be kept clear to provide for the free and safe movement of material handling equipment and personnel. Such areas shall be kept in good repair.

12.5.13 Storage areas that have multiple levels shall have ramps, blocking or grading to ensure safe movement of vehicles between the various levels.

12.5.14 Warnings of the dangers associated with hazardous materials shall be posted at their storage location. Chemical Hazard Bulletins (CHBs) and/or Material Safety Data Sheets (MSDSs) shall be readily available (e.g., in supervisor's office or posted on the storage area bulletin board). In addition, the following shall be affixed on hazardous material/chemicals in order of preference:

1. SA HAZCOM label.
2. Respective CHB.
3. Manufacturer's MSDS.

12.5.15 During the transfer of flammable liquids, portable containers shall be bonded and the dispensing storage tank grounded in order to prevent ignition by static electricity.

12.5.16 Storage areas shall be kept free from the accumulation of materials that constitute hazards due to tripping, fire, explosion or pests. Vegetation control shall be exercised when necessary.

12.6 Manual Handling

12.6.1 Manual material handling tasks shall be avoided as much as possible.

12.6.2 In the event that personnel are required to perform manual material handling tasks, the following shall be observed:

- Supervision shall assess the size, shape, weight and disposition of materials to be handled and plan the most efficient and safest method to accomplish the task.
- Workers shall be instructed in proper manual material handling techniques and practices prior to their work assignment. See Section 12.6.3.
- The assignment of manual material handling tasks shall consider personal physical limitations that vary among individuals. Care shall be taken so as to not exceed these limitations.
- Heavy materials requiring manual lifting shall be stored below waist height.
- The proper tools/lift-assist devices shall be provided for the job.
- Personal protection equipment (PPE) shall be worn as required.

12.6.3 There are four key requirements for performing a proper manual lift:

- A good grip. Ensure maximum use of the palm of the hand, the ball of the thumb and base of the fingers.
- A straight back. The person's back shall be kept straight to maintain its most natural and strongest position. This means that the knees and ankles must be bent and the chin kept well into the chest. The body must be positioned as close to the load as possible.
- Steady feet. Feet shall be spread apart the width of the hips with one foot slightly in front of the other.
- Arms close to the body. Arms shall be kept as close to the body as possible.

12.6.4 Personnel shall:

- Avoid extreme range of motion and twisting their body when lifting.
- Minimize reach and distance the load is carried.
- Avoid lifting loads above shoulder height.
- Minimize weight of loads (by mechanical aids, balancing contents, etc.).
- Keep objects as close to the body as possible.
- Seek assistance when performing manual material handling tasks that may be beyond one's physical capabilities.

12.6.5 In the event an object cannot be handled by just one individual or by a mechanical device, two or more individuals shall be used to handle the object. The movement of the object shall be coordinated in unison.

12.7 Materials Handling Equipment

12.7.1 Materials handling equipment shall be used in accordance with SA GIs, etc.:

- For forklifts, backhoes and other mechanical equipment, see Chapter III-2, *Mechanical and Heavy Equipment*, for further requirements.
- For cranes and other lifting equipment, see Chapter III-7, *Cranes and Lifting Equipment*, for further requirements.
- For lift beams, wire rope slings and nylon slings, see Chapter III-8, *Slings and Rigging Hardware*, for further requirements.

12.7.2 Only qualified operators/drivers shall operate power equipment.

12.7.3 Control of any moving load or material shall be maintained at all times.

12.7.4 Adequate clearances shall be maintained so that personnel are not struck, caught or pinned by moving loads or material handling equipment.

12.7.5 The load capacity of material handling equipment shall not be exceeded. When transferring a load, care shall be taken to avoid shock loading by careful handling of the load.

12.7.6 All equipment with rotating counterweights shall have the complete swing radius barricaded.

12.7.7 Jacks shall be level and set on a firm surface. Jacks shall be operated by hand, not by foot. Jack handles shall be removed at all times when not in use.

12.7.8 Sharp edges, odd sizes or shapes of loads, hazardous or fragile material, uneven weight distribution and routes of travel shall be taken into consideration when planning handling of materials.

12.7.9 Standard hand signals shall be used and clear concise communication maintained between designated signalmen and operators. The most efficient type of communication (e.g., radio or hand signals) shall be used.

12.7.10 Supervisors shall ensure that workers perform proper rigging to balance and control each lifted load. Personnel on the ground shall not stand below overhead loads. No loads shall be left unattended while suspended.

12.7.11 Environmental factors, such as distance visibility, wind velocity and changing soil conditions, shall be considered when planning large materials handling tasks at outside locations.

12.7.12 All vehicles shall be immobilized by chocking their wheels when loading and unloading materials.

12.7.13 When offloading flatbed trailers, personnel shall take precautions to avoid being injured by shifting materials, which may suddenly slide or twist.

12.7.14 Prior to unloading steel, poles, cross arms and similar materials, each load shall be thoroughly examined to ascertain if the load has shifted, binders or stakes have broken, or if the load is otherwise hazardous.